



COAL

GOVERNMENT OWNERSHIP OR CONTROL

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Government Ownership of Navy Coal Land
and Control of the Coal Industry

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etc.



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PREFACE

Coal is a public utility. This is the viewpoint from which this book is written. To the minds of those who use the term generally, "Coal is a public utility" means simply that coal is something that is useful to the public. It means that, of course, but it means much more: it means that coal belongs to the people. On it depend the comfort, even the life, of the people and the commercial supremacy and industrial life of the nation. To waste coal is a sin against the whole people. Those who have bought the coal land are entitled to all the rights that go with a public utility. Their ownership is in the nature of a perpetual lease. They hold it in trust for the public use.

The lease of a coal mine always contains a provision that mining must be carried on without waste, and that the mine may be inspected at any time when such inspection does not interfere with the work of the mine. These provisions help the operator and safeguard the owner.

Control such as that is, in effect, the kind we have advocated for the entire coal industry. Operators who do not need control,—as many of them do not,—will not be affected and need not complain. Those who do need it must have it. The public good is paramount.

For a large part of the coal land, private ownership is the best plan. The stimulus of ownership, the appeal to efficiency, and the urge to new inventories are good for any business. For one part of the coal field, however, government ownership is imperative.

A Battleship Without Fuel! Would that that cry might reach the ear of everyone who is responsible for our future efficiency on the sea! If we are to have a navy in half

a century from now, we must act quickly if we are to have a proper navy fuel. The battleship *Tennessee* is to make a speed of 38 knots an hour. The best Bering River coal could, with the greatest difficulty, drive a ship 18 knots an hour. The best navy coal is the Pocahontas coal. As I write, an agreement made by a company to buy 24,000 acres of Pocahontas coal land in the heart of the field lies before me, along with an advertisement of a tract of 2,400 acres. "Our 'Navy' coal will soon be a memory."

THE AUTHOR.

COAL

CHAPTER I

IMPORTANCE OF FUEL

Wood: Nearly Negligible as Fuel—Destroyed in Clearing Forests—Built into Houses and Wasted.

Natural Gas: Waste in Production and Use—Supply Declining.

Oil: Wastefully Produced—Nearly Exhausted in the Eastern Industrial Fields.

Wood, Gas, and Oil Fuels

When the Roman mythology made Vulcan the god of fire, it also made him god of all handicraftsmen. "He was the divine artist, the creator of all that was beautiful as well as of all that was mechanically wonderful in the abodes of the gods." The spark that he got from heaven kindled the fires that warmed civilization into life on earth. When man began to be a fire-making and fire-using animal, he began to draw away from the other animals. Every new advance in civilization has been concurrent with new sources and new uses of heat. Fuel, then, has been a matter of large concern to mankind. Nature has been very kind to a large part of the earth. Fuel sprang unbidden from the ground in its trees and grass.

Wood As Fuel

In the largest part of the United States, the pioneers found the hills and valleys covered with timber,—a fuel ready at hand, simply beckoning to the axman to come and get it. It was his building material as well as his fuel. From it came the logs for the walls of his cabin; from it he hewed the puncheons for his floor; from it he split and shaved the shingles for his roof. He did not grudge the fuel that he put in his house, for it was so abundant as to be a nuisance. He did not spare it. He rolled in the back-log and fore-log, and split the kindling for the roar-

ing fire over which the busy housewife swung her crane burdened with its load of pots and kettles. On the wintry evening

They gathered round the fire,
And piled the wood on higher,
As the song and jest went round.

All these uses made small inroads into the fuel that must be sacrificed. The timber that could not be used was an encumbrance. It must be cleared away to make room for the potato patch, the ever-widening corn field, and the wheat, oats, and rye fields. It must be felled and grubbed and destroyed. The logs must be heaped together and burned. So, this is the day for the log-rolling. Came the neighbors with their oxen and log-sleds, and with freshly ground axes. Huge trees were felled, and the logs, which would be the wonder of our lumbermen, were rolled together and burned. So they went from cabin to cabin,—neighbor helping neighbor for help in return,—in this deplorable, but necessary, destruction of fuel.

To-day our hills and valleys are almost denuded of their trees. These trees are built into our houses, turned into paper, burned in our forest fires, or wasted, or destroyed. Comparatively little systematic effort has been made to reforest, and not enough to prevent and control forest fires. The price of building materials has advanced manyfold; wood as fuel is scarcely considered in a large part of the country.

Natural Gas As a Fuel

Where it is found in any special region, natural gas is the ideal fuel. It has from one-and-a-half to ten times as great heat value as gas that is artificially produced. It, too, is following rapidly in the wake of our wasted forests. Our waste of it has been criminal. No part of this crime of waste can be condoned as was the destruction of timber when it gave way to the plow. Some of the waste resulted from ignorance of a way to control the gas flow, and from a lack of pipes to carry it away.

Gas was first struck in wells which were drilled for oil. When gas was struck the discoverers did not know what to do with it, or how to control it. One of the largest gas wells in Pennsylvania,—the McGuggin well in Washington County,—was set on fire, and for months was simply a great geyser of flame, the roaring of which could be heard for miles—the Mecca to which night picnic parties made pilgrimages, to see the eighth wonder of the world.

When gas wells were drilled near a town and the fluid brought under control and piped along the streets, the open street lights were great torches that fouled the air and wasted the gas. When used in grates and furnaces, it was used without thought of economy. As there were no meters, the family burning the most gas was just that much ahead. The amount annually wasted may be rightly reckoned as a billion dollars worth.

Now the first gas wells are exhausted. The region of production is being pushed to the South and Southwest; the day of limited supply has come; the day of exhaustion has come in some sections and is approaching in nearly all, and the pipe lines now carrying natural gas must carry artificial gas, or be useless.

Oil As Fuel

Oil, when properly burned in a furnace properly constructed, is a good fuel. More's the pity that it had not been less wastefully used and more prudently produced in the parts of the United States in which industrial fuel is in greatest demand. When wells were sunk in Western Pennsylvania, which produced five thousand barrels a day of the best oil on the market, there was a mad rush to drill and get out all the oil at once. As many as thirty wells half-a-mile deep were drilled on a hundred-acre farm. The market was flooded with oil. The demand then was not nearly so great as it is now. The best Pennsylvania oil was sold for fifty cents a barrel, or less. Oil was so cheap that there was little incentive for carefulness in its

use. Oil-saving was more expensive than oil-buying if it involved expensive change in methods of use.

Soon the great oil fields were depleted. Now the fields that were once the scene of feverish activity are almost deserted. If a new well is put down that produces a few barrels a day, the owner is satisfied; if it is a dry hole, he is not much surprised. To sink a well in a nearly exhausted field is, anyway, a gamble. Fortunately, new fields have lately been found, and new sources of outside supply have given a new lease of life to oil as a fuel supply in some parts of our country, but not in the center of the great industrial regions, which at present most need the fuel.

The new oil supply will be treated in connection with coal auxiliaries.

CHAPTER II

COAL, THE PRESENT FUEL OF THE WORLD

Coal in Time of War: What It Did for Germany—What It Did for the Allies.

Coal in Time of Peace: Importance to England for Her Industries and Export Trade—Importance of England's Coal Export to France, Italy, and South America—Value of English Coal to United States When a Strike Limits Supply.

The realization of the all importance of the coal resources of the United States has come to us very slowly. In fact, the knowledge that we had any to speak of is scarcely a century old. When King Charles II gave William Penn a "deed" to what is now Pennsylvania, he tried to reserve to the Crown a share of the valuable minerals in the ground. He reserved one-fifth of all the gold and silver. He didn't think the coal then as valuable as the two bear-skins that Penn was to give every year. In the patents to the land in Pennsylvania given by the Commonwealth in 1780 and 1790, reservation is made of one-fifth of the gold and silver, the grantors being all unconscious that the land was underlaid with a metal of great value to the State, and not underlaid with silver and gold.

A century ago,—in 1820,—but three hundred and sixty-five tons of anthracite coal were shipped in a year from mines in Pennsylvania, and in 1840 only four hundred and sixty-five thousand tons of bituminous coal. As long as wood in abundance was available for fuel, as long as the rude water-wheel ground out the grain, as long as trains of pack horses carried over the mountains what the settlers produced and brought back what they needed in exchange, they had little need of any other fuel. The canoe and raft on their streams, and their wind-driven sail-vessels sufficed for their commerce. Now the varied industries, the railroads, the steam-driven boats and ships

and the millions of homes have increased the demands of the people, until anthracite production is nearly a hundred million tons a year and bituminous more than half a billion.

The National and State governments have in general taken little interest in coal. They parted title to almost all the best coal in the United States along with title to the surface, never even raising the question as to whether it was the best thing to do. Now, when they do awake to the inquiry, they find it, if not too late to remedy any part of the mistake, at least presenting a very serious situation.

Coal in War Time

Never had the all importance of coal been so impressed upon every nation in the world as during the great World War.

Germany's Great Coal Fields Fought Her Battles for Her

For years, Germany's great factories built about her coal fields had wrought with fiendish skill and ingenuity her engines of destruction in preparation for the slaughter she planned. For years her chemists extracted from her coal the explosives that shattered the shells and produced the gases that dealt death to her enemies. Cut off by blockade, had disaster come to her coal mines, every munition factory would have been closed, transportation of troops and supplies paralyzed. The struggle would have been over. Her coal kept Holland neutral,—indeed friendly,—since Germany furnished Holland coal in exchange for food,—and later the Kaiser.

An important part in her efficiency in equipment came from the byproduct ovens of Belgium and Northern France, just as the loss of the mines was an almost irreparable disaster to France.

Not only did Germany's coal fight her battles on land, but her captured coal did what fighting on sea her pirate cruisers were able to do. The depredations made by such German cruisers as the *Emden*, *Dresden* and *Kronprinz Wilhelm*, were made possible by their ability to take coal

from their captured ships at sea. Just as the submarine that did such deadly work for the Germans was an American invention, so the device that enabled their cruisers to coal from their captives was an American suggestion.

William H. Bechler, an officer in the United States Navy, was a naval attaché at Berlin. He read a paper in 1902 describing his marine cableway, which coaled the battleship *Massachusetts* from a collier at sea. German papers commented at large on the paper and appealed to German engineers to solve the problem. They did solve it, and their cruisers carried apparatus by which they could take coal from another vessel at sea, both driving ahead at the rate of ten knots an hour.

We had solved the problem, and our colliers on the sea were equivalent to the addition of many destroyers to our fleet. Without being able to coal at sea, each destroyer would have been obliged to return to a coaling station every few days; and while going and coming would have been of no use to the navy, but exposed especially to attack by submarines, which made it a point to lie in wait to destroy ships on the routes to coaling ports.

Coal and the Allies

Coal was just as essential, of course, to all the other nations engaged in the war.

One of the greatest disasters to the Russian army was caused by failure of coal supply for their engines on the trains that were to bring re-enforcements and munitions.

England was hard put to it to furnish the coal that she must supply, if the Allies were to win the war. Her ships needed more coal than ever. Her factories were supplying not only her own home needs and the needs of her own armies, but were making guns and ammunitions for her allies. France had lost her northern coal fields with their normal output of 20,000,000 tons a year, together with factories in the regions held by the Germans. England, in time of peace, sent 20,000,000 tons to France; now France needed not only her normal importation, but the

increased demand for her munitions plants and other factories, and also to make up the twenty millions that the German army held.

Italy, practically dependent upon outside coal, almost lost the war when her munition and coal supply failed. The cry, "Men and guns and ships will win the war!" was almost superseded by the cry, "Coal will win the war!"

Then in England came the refusal to call miners to the colors. Soldiers were even withdrawn from the army to work in the mines,—a work as important for winning the war as fighting in France. The Home Secretary announced:

"It has been decided, in view of the importance of the national interest of maintaining the output of coal, that no person employed underground in a coal mine and no person employed on the surface as winding engineer, pumper, weighman, electrician, or mechanic is to be called upon for service in the field without consent of the Home Office."

In the United States operators and miners vied with one another in their effort to furnish coal for battleships, for transports, for soldiers in camps, for soldiers overseas, and for our allies. Everywhere the eye met the placard: "Coal will win the war!"

Coal in Time of Peace—Coal Mining in England

When the Great War was over and England's soldiers were on their home land again, there seemed to be a feeling that coal was a kind of wartime necessity, and that now that peace was come, strenuous production was not needed. Miners did not work vigorously and efficiently, and production fell off greatly. At length, the miners struck for higher wages and shorter hours, which meant less production and higher prices. The people of England were panic-stricken. Coal for their factories and for export lies at the foundation of their ability to pay their enormous war debt, and hold their place in the world's business.

An influential English paper, with almost a wail of despair, exclaimed: "We must have coal, and cheap coal, or perish industrially."

Coal Mining in the United States

When the armistice was signed, and our soldiers were brought back to the United States, we ceased to talk or think of coal, except as we classed it among the things we had to buy at a higher price than before the war. Coal is among the things we have, of course, and having these things, of course, we cease to think whether they are important or not.

It needed a new shock to stir all the people to realize that, as at present organized, we cannot live without coal. The shock came in the resolution adopted by the United Miners' Union that if the demands made by the workers were not conceded they would strike on a fixed day,—that nearly half a million men would cease to produce coal just at the beginning of winter. Then all the people knew that coal is not alone to win wars, but is essential in time of peace; that without it our factories will stop, millions of people will be out of employment and without the means of livelihood; most of our railroads will not be operated, and many of the people will suffer or die with cold.

The President called it an "impending disaster," saying further:

When a movement reaches a point where it appears to involve practically the entire productive capacity of the country with respect to one of the most vital necessities of daily domestic and industrial life, and when the movement is asserted in a time and manner calculated to involve the maximum of danger to the public welfare, in this critical hour of our country's life, the public interest becomes the paramount consideration. The matters with which we now deal touch not only the welfare of a class, but vitally concern the well being, the comfort, the very life of all the people. I feel it my duty to declare that any attempt to carry out the purpose of this strike, and

thus to paralyze the industries of the country, with the consequent suffering and distress of all our people, must be considered a grave moral and legal wrong against the government and people of the United States. I can do nothing else than to say that the law will be enforced and the means will be found to protect the interests of the nation in any emergency that may arise out of this unhappy business.

CHAPTER III

STRIKE OF THE MINES

Strike of the Mines: When They Have No More Coal—We Have Wasted Our Coal in Production and in Use—Causes of Waste—Cheap Coal Land—Fierce Competition Due to Over-Production—Financial Weakness of Coal Companies—Apathy of the Public—Misleading Statement of Our “Inexhaustible” Supply. George Otis Smith’s Pessimistic Speech.

If the temporary reduction in the output of coal in the United States is a disaster, what will it be when the production shall entirely and permanently cease ?

During the strike in 1919, non-union and various union mines worked, so that the output was maintained at from forty to fifty per cent of normal. If a falling off of fifty to sixty per cent of normal production is a calamity, what of it when one hundred per cent of production shall cease ?

No strike will continue for long to cut off the entire coal supply. The people will not stand for it long. The entire people would not stand calmly by idle mines and freeze. Their helplessness and weakness in face of a strike seem to indicate that they would, but patience would reach a limit.

However, there is coming a worse disaster than a miners’ strike. It is a strike by the mines when they have no coal to give.

The American people have been spoiled by the abundance of our natural resources. We think as little of their exhaustion as of the exhaustion of the air. But it is time for legislators, statesmen, and thoughtful people to take stock of such a vital necessity as coal. It is time to ask such a serious question as: “What will be the status of the nation when all the coal in what is now the thickly settled regions of the country,—and what is now the industrial field,—is exhausted? How will it affect the whole

people and the nation when the time comes, as it will in a comparatively short time in the life of a nation, when all the best coal in the United States,—in Pennsylvania, West Virginia, Ohio, and other Eastern States,—is gone, or where so little remains that its production is negligible?"

Of course, we languidly agree that coal is not like most of our other resources, that once exhausted there can be no renewing. Much of our land whose fertility has been exhausted by unscientific farming, even whose surface has been seamed by the floods caused by reckless destruction of the timber on the hillsides, may be made fertile again by irrigation and fertilizing, or be re-forested. The farmer's flocks are followed by other flocks. Every year a new flock of "lambkins skip upon the hillside"; every year a new "lowing herd winds slowly o'er the lea," but the coal used or wasted is never renewed.

Yet this essential and unrenovable resource is being used and recovered wastefully. Our waste of coal has been reckless and indefensible. Billions of tons have been practically destroyed by our methods of mining, and other billions wasted in our unwise use of it after it is mined. Some of the reasons for such waste may be stated as follows:

First. The Low Selling Price of Coal Land

In the early development of coal mining, in parts of the anthracite region of Pennsylvania, coal land containing many beds of the finest coal in the world was sold at four cents an acre, or leased at a rental of an ear of corn a year. In the great bituminous fields any price received was so much money found by the owners.

Even now, in some parts of the country, coal land is sold at a price which, if it does not provoke waste, does not discourage it. If it becomes expensive to mine the acres of coal that lie on the outskirts of the holdings, the mine is abandoned and a new mine opened. If, to support the roof so that pillars of coal can be recovered, it costs too much to give the operator enough profit, the pillars

are left undrawn and lost forever. If the roof is not good, and expensive to prop, a foot or two may be left at the top to support the roof. It is better to lose the coal than to buy and place the props. Coal is left at the bottom for a reason of expensive coal. A few tons lost counts little on the operator's ledger, if it only costs him in the land a very small fraction of a cent a ton.

Second. Unrestricted Production and Consequent Fierce Competition for a Market

The coal mines already opened in the United States have an annual capacity of more than 750,000,000 tons. In 1918 they actually produced 585,883,000 tons, working only two hundred and twenty-five days, much of the time lost being by lack of cars or lack of men. The normal demand is now, in normal times, not much above half a billion tons. Ever since the anthracite strike in 1902, when production in the bituminous fields was much stimulated and many new mines opened, capacity of production has been greater than demand. The natural result has been fierce competition for sales. The operator was at the mercy of the buyer.

The price of coal was so low most of the time that it was not possible to mine any but easy coal and make a profit, and not possible to pay a decent wage to labor.

The average selling price of coal in the United States for the years 1890 to 1900, inclusive, was \$1.06 a ton, with the highest value \$1.16 and the lowest 95 cents.

The average number of days worked was 199, ranging from 214 to 178.

The average selling price of coal in the next decade, 1901 to 1910, was \$1.10, and that included the year of the great anthracite strike, when bituminous coal was highest. In 1909 in six States the amount received for the coal sold was less than it cost to produce it. The owners got nothing on the average for interest depletion, depreciation, or salary expenses. In 1914 Illinois and Indiana operators, in an agreed statement, appealed to the President

for permission to initiate a solution for prevailing conditions—this to be subject to review by the government. The following are a few excerpts from their appeal:

The normal state of this industry for years has been such as to waste the coal reserve which now insures the safety of the eastern part of the country, and deprives the operators of any hope of profit. . . . The coal sells in eighteen states. The business is therefore interstate. The operators are amenable to the anti-trust laws, which they believe forbid any co-operation among them. Because they cannot co-operate they cannot simplify their selling methods or reduce their selling and operating costs. . . .

The mines are within these two states and the states regulate their operating methods. The effect of the nation's anti-trust laws is to cause them to compete without restraint. This has produced a decreasing selling price. The states' laws have caused a rising production cost. The rising cost of production and the falling selling price have long since made profit impossible and now threatens the safety of the whole business structure, as well as of the miners and the public. [The requisite investment in plant and equipment has increased one thousand per cent in twenty years.] Enforced competition has opened three mines where two were needed, and employed three men where two were needed. These mines and men can find work but one hundred and seventy-five days out of three hundred; hence higher wages have to be paid than the production warrants. Their labor cost is 93 cents per ton, selling price \$1.14 in Illinois and \$1.11 a ton in Indiana. Out of this margin must come salaries, selling costs, land depletion, depreciation, repairs, cost of materials used in the mines and eight or ten other major expenses. This leaves no possible net profit. One obligation resting on the operators is to recover the pillar and top coal. It costs too much; it cannot be done. For every two acres they exhaust they leave one in the ground unrecoverable. In Illinois every year twelve thousand acres are exhausted instead of eight thousand; in Indiana three thousand instead of two thousand. In the nation one hundred thousand acres instead of sixty-five thousand are exhausted.

Third. The Financial Weakness of Many Operating Companies

To make a mining operation successful, to secure a low cost operation, the mine must be well equipped. This requires a large outlay of money. Shafts and manway

must be sunk and, probably, concreted. Expensive tipple, grading, siding, expensive engines, boilers, pumps, fans, etc., must be provided. It will not pay, in general, to incur these expenses unless a large acreage is bought and a long life for the mine is assured. Too often a large part of the money is obtained by mortgage or bonds. Unseasoned bonds are not much sought after by investors, and the bonds bearing a high interest rate have to be sold at a discount. At the outset the company is burdened with large fixed charges. In addition, the equipment expense not covered by the money raised from bonds, and the furnishing of working capital must be provided for by issuing stock,—often too much stock for the real equity in the property. A considerable time is consumed in getting ready to operate commercially. It takes time to sink shaft and erect tipple and install machinery. After the coal is reached by the shaft, entries and airway have to be driven and rooms turned before even a fair start has been made in production. The output is small for a long time, and costly to produce. In the meantime, interest goes on. Soon stockholders clamor for dividends. If the mine is operated by the owners themselves, unless a large operating sum has been provided, the pinch of debt begins to be felt. Miners' and operating expenses have to be paid. The coal that is sold may be on slow payments: a new company is indulgent to buyers in order to make sales. Interest is coming due. Coal must be put out. "Easy" coal must be mined. It is wasteful, but it is a wild run to cover, to outstrip the receiver. The receiver most likely wins the race after a short run. When the new company takes possession, it finds much of the mine spoiled, much valuable coal hopelessly lost.

If the equipped mine is operated under lease, the royalty has to be large to cover the owners' fixed charges; a minimum royalty payable by the lessee, whether earned or not, is expected. The lessee is not especially solicitous about the future of the mine after his lease expires. He "hogs" the coal, piles "gob" against the pillars so that they

cannot be drawn, mines "easy" coal, and wastes the coal more recklessly than even the sheriff-pursued owner would have done.

Fourth. The Apathy of the People

It may not be using exactly the right term to call "the apathy of the people" the cause of the waste of coal in mining. It is, no doubt, more accurate to say they failed to devise and apply a *preventive* or *check* on waste. If the whole people had for half a century been as awake to the value of coal as they were during the Great War, they would have insisted that our government conserve our supply and devise some way to stop waste. So far as they in general had any thought about the matter at all they reasoned: "The governments of the States and United States have sold the coal with the surface of the land. The new owner has paid his money for the coal as truly as for the surface; if he chooses to waste his own property, that is his concern."

Recent events have aroused the people to the fact that they have a paramount interest, as a nation, in the coal,—that all the coal is, in fact, held in trust for the whole people; that coal mining is essentially different from surface farming; that coal mining is a destructive industry as farming is not, and that it is doubly destructive when coal is destroyed.

While coal cannot rightfully be taken from its owner without reasonable compensation, the owner cannot do with it exactly as he pleases. He cannot refuse to sell it and thus freeze us. If the refusal to sell causes death, he is morally guilty of murder. During the war, if mine owners had closed their mines and refused to sell their coal and thus paralyzed every energy that won the war, they would have had a rude awakening. However, that would have been true of the wheat owner, as well. In time of peace when miners refused to work, and so far as possible hindered others from working, if this refusal to work and hindering others from working caused death,

they were guilty of murder. If men are able to work and will not work, and that refusal causes death, then they are murderers.

If we are awake to the value of coal to us, how long will we stay awake? We are awake to-day and asleep to-morrow. If there is a shortage of coal, we know that it is because the coal is not taken from the ground. As to the future, there will always be coal in the ground ready to be dug. Anyway, "sufficient unto the day is the good thereof."

If we are told that wasteful mining methods and wasteful use are destroying what, in fact, is held in trust for us and by us, we would express our real indifference by saying: "We will have enough for us and to spare." That coal is at the base of our commercial and industrial supremacy arouses us very little. Besides, our coal is "inexhaustible." Our "inexhaustible resources" rings from every Fourth of July platform: we can feed the world, we can coal the world, we can whip the world. But not only are we lulled to quiet by these beautiful writings and speeches, but by misleading statements supposed to come from sources which we ought to—and do—respect.

Fifth. Misleading Statement of the Amount of Our Coal Resources

The rhetoric of the orator and the boast of the fervid American are generally taken at a discount. But when they quote so respectable an authority as the Geological survey of the United States everybody takes notice. When they say that the Geological Survey estimates that the coal supply will last four thousand to six thousand years, the average hearer does not trouble himself to ask: "Where is the coal; where will our posterity have to go to get it; what kind of coal; how thick are the veins; how deep will they have to go to get them?" He thinks it means that the regions that are now producing good coal—such as Pennsylvania, West Virginia, Ohio, and other Eastern States—will be mining coal just as they are now

four to six thousand years hence. If so, why trouble our brains about conservation. The end of the world will, maybe, come about the time the coal is exhausted; if not, the ingenuity of our American scientist will discover a substitute. Why bother, anyway, about our so distant relatives?

Our confidence in the accuracy of these optimistic statements is somewhat shaken by this speech lately made by George Otis Smith, head of the Geological Survey, who is certainly able to say in what sense those optimistic reports are meant:

America's coal is her pride. More than half of the world's estimated supply is in the territory of the United States. Our coal in 1918 constituted forty-eight per cent of the coal that went into the world's bins. That percentage measures the share of our coal industry in the world's business, for relatively few of the wheels of modern industry and commerce can turn unless coal furnishes the energy. However, the inheritor of great wealth often proves a spendthrift, and pride goes before destruction. So, our first impression as to America's wealth may be too optimistic, and we may need to think less of the millions and millions of tons of coal which we are told lie awaiting our needs over the length and breadth of the land, and to ask for more details as to where this coal is, and how much of it remains in the older mining districts. Before we indulge in mental arithmetic in figuring out the life of our coal resources, we may as well set down the broad fact that the best and most accessible coal is mined first. From this premise follows the practical prophecy that with the passing of time in our rapid industrial expansion, we may expect for our future coal output decreasing quality and increasing cost.

Let us try to picture the extent to which we have mined our best coal, and also the rate at which we are using up the fuel resources upon which so many industries are founded. I have had figures compiled for me which present the available facts regarding typical coal fields.

First. The Pittsburgh coal bed. If it is mined at the present rate, the exhaustion of this coal bed, the largest in Pennsylvania, must be measured by the span of a single generation; at least we can see the peak of production close at hand, if indeed, it has not already been passed, and long before the end of this century coal mining in the Pittsburgh field will be a memory except where a mine here and there is working on

outcrop coal, or pillars or odds and ends left behind in the big days of Pittsburg coal.

Second. Even when we turn to examine a less nearly exhausted coal field, such as the Pocahontas field in Virginia and West Virginia, we find that the increasing rate of output tends to cut down the earlier and more optimistic calculation of expectancy of life. Expressed in human units, the estimates for the Pocahontas field are reduced from four or five generations to three, or even two. And these are the fields which are regarded as our choicest industrial coals.

In the coal fields of Ohio, Indiana and Illinois the outlook is better, but the coal is poorer. In these states even without allowing for the increased duty placed upon their coal as the Eastern fields are approaching exhaustion, we may put the expectancy of life at a few centuries.

These National resources are of value only as they are used, but no business man shuts his eyes to the rate at which the stock of raw material in his storehouse is being depleted.

This estimate of the expectancy of the life of the Eastern coal field seems rather too pessimistic for Pennsylvania and the Virginias but too liberal for Indiana and Illinois. Scholl, several years ago, estimated that the coal of Illinois will be practically exhausted in two hundred years, if no additional demand be made upon it from the exhausted Eastern fields. If it is true that in a century the coal that was formerly supplied by Pennsylvania and Virginia will be exhausted and its place has to be partially taken by Illinois coal, the two hundred years will be greatly reduced. We are surprised to read the statement by the head of the Geological Survey that Pennsylvania coal will be merely a memory in less than a century, while we have been constantly regaled with the flourish of four thousand to six thousand years of coal life. Certainly the Geological Survey must be misquoted, or George Otis Smith, the orator, must be talking of a different matter than Smith, the director.

Let us turn, then, to the latest estimate actually made by the Survey, in order to see what we may really expect, if it is reliable.

CHAPTER IV

COAL RESOURCES OF THE UNITED STATES

ESTIMATED BY
THE GEOLOGICAL SURVEY

Estimate Amount of Coal Originally in the Ground—Estimate Includes All Kinds of Coal Down to Depth of Six Thousand Feet, in Veins Fourteen Inches and More in Thickness, Having Ash Thirty Per Cent and Less—Ways of Estimating Life of the Coal Supply—Rate of Consumption Continue As At Present: Time, Three Thousand to Four Thousand Years—Rate of Increase of Consumption Continue As for Last Twenty Years: Time, a Century or Two—Parker's Probability Curve—Estimate of No Value in Determining Length of Our Industrial or Commercial Supremacy—Agree That Our Best Coal Will Be Exhausted in a Century.

1. *Estimate of the Amount of Coal Originally in the Ground*

The estimate of the Geological Survey includes the "total quantity of coal that ever will be mined in the United States."

Marius R. Campbell, in Professional Paper 100, issued by the United States Geological Survey, thus explained the method they pursued:

"In undertaking to make an estimate of the original tonnage of coal in the ground, certain assumptions must be made as a foundation, and the results obtained will depend largely upon these assumptions. The three principal assumptions are: (1) minimum thickness of bed of the different ranks and grades of coal that can be mined; (2) maximum depth to which mining may be carried in the different ranks, and (3) maximum percentage of ash that may be permitted in the different ranks of coal. In attempting to make estimate of the original content of the different fields of the United States the Geological Survey decided that it would be a waste of money and time to

attempt to make estimates based on present mining practice in the United States, for such estimates would be misleading in that they would not represent the total quantity of coal that undoubtedly will be made available in the future. With this point in mind it was decided to attempt to estimate the total quantity of coal *that ever will be mined in the United States*. In doing so, the present mining practice throughout the world was considered, and the assumptions regarding maximum depth, minimum thickness, and maximum impurities were based upon present practice in the world. But, in general, the limits now observed were exceeded, because it is almost certain that the future will go far beyond the present operations."

As the deepest coal mines in the world (in Belgium) reach a depth of about four thousand feet, and as shafts for copper and other metals have been sunk to depths below five thousand feet, it was thought that future coal mining might be carried to a depth of six thousand feet. But in order to meet varied requirements, two limits were set, one at a depth of three thousand feet for easily recoverable coal, and the other at a depth of six thousand feet.

Similarly, the *minimum thickness* of coal bed mined in the United States is about fifteen inches; therefore, fourteen inches were taken as the minimum of high-rank coals for estimating the original tonnage in the several fields. The minimum thickness varies according to the rank of the coal, being about two feet in sub-bituminous coal and three feet in lignite.

The maximum *percentage of ash* permissible was thirty per cent, but it is questionable whether it would not better be placed at twenty-five per cent.

Basing the coal supply on these assumptions, maximum *depth three thousand feet*, minimum thickness of vein fourteen inches, maximum percentage of ash thirty per cent, and the best information obtainable as to area, they estimate the original content to be 3,553,637,100,000 short tons.

Estimating coal beds of like character down to *six*

thousand feet, the content is placed at 4,231,352,000,000 short tons.

2. *Estimates of the Life of the Coal Resources of the United States*

Having estimated the original content of the coal areas of the United States, in order to determine the probable life of the coal, we must fix upon some rate of depletion.

Three guesses were made by the Geological Survey for the purposes of determining the life of the coal.

First. Suppose the Present Rate of Consumption to Continue Till All the Coal Is Exhausted.

The depletion at present, including waste, is at least a billion tons each year. At that rate, 3,200,000,000,000 tons would last thirty-two hundred years, and 4,000,000,000,000 tons would last four thousand years. These are the estimates that the public generally attributes to the Geological Survey.

Second. Suppose the Rate of Output to Continue Each Decade, to Increase At the Same Rate At Which it Has Increased in the Last Two Decades.

This assumption leads to a quite absurd conclusion. In the last twenty years the coal output has increased threefold. If the output increases threefold in the next twenty years, it will, including waste, be three billion tons in 1940. Continuing to increase at that rate, trebling every twenty years, for one hundred and fifty years, it would reach the enormous depletion of 3,270,000,000,000 tons a year. That is, the calculated output in the year 2070 would be as great as all the estimated coal originally in the ground down to three thousand feet. Of course, the supply would be exhausted long before that, in not more than seventy-five years.

Third. E. W. Parker's Forecast.

In 1908 E. W. Parker attempted to forecast the time when coal production in the United States would reach a maximum, and what the annual production would be at that time.

He grouped the production by decades, from 1835 up to 1908, and plotted these groups, thus making a curve of past production. Then, from the law of increase that appeared in this past production curve, he continued the curve and found that it reached a maximum in 2055, when the production will be five times the present output. After the maximum has been reached, owing to increased cost of haulage and hoisting from deep shafts and working thin veins, the production would gradually decrease. In a way thus briefly outlined he estimated the time limit of all coal, good, bad, and indifferent,—at two hundred and thirty-five years.

Campbell, in commenting on these estimates, says:

"The fact must be remembered, that the bulk of the coal being mined to-day, is the best in the country, and that before long, perhaps within fifty years, much of the high-grade coal will be exhausted."

In another part of his report he says:

The great bulk of the coal of this country is low-rank bituminous, lignite and sub-bituminous, and the high-rank coals are relatively scarce. This is an important point in conservation, as it means that our best coals will be the first to be exhausted, and that such exhaustion may occur in the not very distant future. The best steaming coal, the semi-bituminous, is limited practically to two eastern provinces, and the exhaustion of this coal will be a greater calamity to the country than the loss of all the anthracite, for it is adapted to more uses and has greater efficiency.

This estimate by the Geological Survey has been discussed at considerable length because it has been used so extensively and ignorantly to the misleading of the people in general, and being misquoted and distorted, has so minimized the gravity of the coal problem that legislators and statesmen have not thought there is a coal problem.

We find, then, that this estimate is:

First, An Entirely Academic Estimate

It has no value in determining the duration of our industrial and commercial supremacy among the nations of

the world, nor even our industrial and economic life. The subject would have more vital interest for us if it were divided into three divisions:

1. The division lying east and south of the Ohio River and Ohio, and east of the Mississippi River. (a) The present content of that field is known to a fair approximation. (b) The annual depletion is known, and if we assume that the present rate continues till the coal is exhausted, the problem is fairly definite. (c) The length of life is likely to be so small that any assumed law of increase will not be hard to apply. If George Otis Smith is right, the answer will be a *century*.

2. The division lying north and west of the Ohio River and the Pennsylvania line, and east of the Mississippi. As much is known about that as about Division 1, and our answer will be two centuries.

3. The great coal fields of the West. We are knowing every year more about the coal of the Far West. It will be a fruitful field for the speculation of the Geological Survey; but at present the Divisions 1 and 2 are of paramount interest. Apply the assumptions made by the Survey to Division 1:

(a) *The three thousand to six thousand depth limit*

Any coal counted in the estimate by the Geological Survey below one thousand, was not found in Division 1. In the bituminous field of Western Pennsylvania the depth of the Pittsburgh coal varies from zero to seven hundred feet, average about four hundred feet. The other veins, where they are worth considering, are not on an average any deeper. In West Virginia, the Pottsville veins are from one hundred and fifty to five hundred feet below the surface. There is no vein that is one thousand feet deep in the Appalachian coal field. So it is evident that any coal counted by the Geological Survey below one thousand feet must have been in other fields than Division 1.

Any coal counted by the Survey below one thousand feet was not found in Division 2.

In Ohio the coal is not deeper than in Pennsylvania and Virginia. In Indiana it varies from stripping coal to six hundred feet. In Illinois very little of the coal is one thousand feet in depth, but most of it two hundred to five hundred feet. It is evident, therefore, that the great bulk of coal included in this estimate is poor coal and lignite.

(b) *Thickness down to fourteen inches.* It is safe to say that no coal vein as thin as fifteen inches is now operated commercially except in some parts of the anthracite field, or where the thin vein is separated from another vein by such a thin stratum of rock that the two can be worked together.

The operator who would sink a shaft six thousand feet deep, with the hope of working a fourteen-inch vein of coal, in the first place wouldn't find any such vein in any region that is now being mined, and in the second place could not work it if he did. The expense of sinking shaft and manyway six thousand feet,—or three thousand feet, for that matter,—the expense of brushing and hauling out the rock that must be taken from the top or bottom of the vein in order that it could be operated at all, ventilating and cooling a temperature of 120 to 140 degrees, the small output, the high wages that must be paid to induce men to work, is so great that it seems to us absurd to include it in any estimate.

Second, Value of Geological Survey's Estimate

The Geological Survey does not treat its estimate in the serious way in which it is generally and naturally taken by those who read the quoted statement: "Coal will last four thousand years."

Campbell says:

"The high-grade coal may not last more than fifty years." "The high-rank coals are relatively scarce." Exhaustion may occur in the near future.

George Otis Smith, head of the Survey, says:

"The Eastern field will be exhausted in one, two, or three generations."

No doubt, coal will be mined in the United States for many,—perhaps thousands,—of years. Coal will be mined in Pennsylvania, West Virginia, and Ohio, long after the main part of the coal has been depleted and industrial and commercial supremacy, as far as they depend on coal, have passed from us.

Coal in veins too thin to be considered now will be mined at very high cost. Poor coal and lignite will be burned in byproduct ovens, or in other ways not now known.

Aside from the fact that ninety-eight per cent of the coal we consume or export comes from our best coal, is the disturbing fact that parts of the field in which we were counting on good coal are found to be barren of coal. Professor S. C. White says of one such field:

“We must accept the fact that at least six counties in West Virginia, in which the Pittsburg vein of coal was supposed to exist, are entirely without the vein.”

In regions that are often reported as having a large number of veins there are often found to be not more than two or three, more generally but one really workable vein. A stump orator, a promoter, or even an honest man, tells us that West Virginia has twenty veins of coal. Naturally, the hearer expects to find twenty workable veins, one above the other. He is surprised when presented with the record of borings that have been made, which show that the veins run from black shale, a mere trace, a few inches thick, one foot, two feet, with large strata of rock intervening, and only one or two workable veins.

CHAPTER V

WHAT CAUSES ARE AT WORK TO PROMOTE COAL CONSERVATION

Low Price of Coal Land Partially Cured—Over Capacity of Mines Still a Menace—Mines Have More Expensive Equipment Than Before the War—Good Coal Land Soon Will Be Dear and Scarce—Competition of Sellers Will Cease, for Demand Will Exceed Supply—Weak Companies Will Be Eliminated—Four Classes of Coal Land to Be Considered: Coal Land Held for Government Use—Coal Land Leased for Mining Commercial Coal—Coal Land in Private Hands That Needs Regulation—Coal Land Not Needing Regulation.

Having (1) discussed the importance of coal to us for military efficiency and for our industrial and commercial life and supremacy; (2) having shown that coal is basic, and that all the people have such claim upon our coal supply that private holders cannot do with it as they please, cannot at their pleasure withhold it from the people, must not sell it at an exorbitant price, must not waste it with impunity, that labor must not refuse to produce it and hinder others from producing it; (3) having shown that our good coal easily and cheaply won, is now being mined almost to the exclusion of the poorer coal, and that therefore our good coal is soon (measured in the life of a nation) to be exhausted; (4) having shown that much coal has been lost in mining,—one and a half tons for every ton of anthracite produced prior to 1893, and nearly as much bituminous according to the report of the Commission on waste in Pennsylvania, it is worth while to ask, and all the nation ought to ask: (a) *Have all the causes of waste been eliminated, or if not all, how many of them?*

Some of the causes which promoted waste have been given us:

(1) *Low Cost of Coal Land*

In all the bituminous coal fields there are still very cheap coal lands for sale; but in a considerable part of the East-

ern fields, coal land is now held, or sold at so high a price that the owner cannot afford to waste his coal.

Veins that were formerly condemned as being too thin to operate profitably are being worked, and abandoned mines are being reopened, where they have not been totally ruined in their former working. This is true in the anthracite field and in some of the coking fields. The author knows of an operation that originally consisted of only thirty-three acres of coking coal, which cost three thousand dollars an acre, and which required the making of a narrow-gauge railroad of several miles to reach it. Every ton of that coal will, no doubt, be mined. But large acreage has been bought at from ten to forty or fifty dollars an acre, and large acreage of good coal still offered at those prices.

(2) *Destructive Competition.*

This has been one of the capital causes of waste. Has its threat been eliminated? The capacity of all our coal mines is 2,715,000 tons a day. If they would operate three hundred days in the year, as the mines in Belgium often do, the output would be 814,500,000 tons. If they operate only two hundred and fifty days in the year, the output is 678,500,000 tons. The market demand now is not more than half a billion to 550,000,000 tons a year. The surplus capacity is, therefore, at least 125,000,000 tons a year. The result is either a price-cutting, to try to force this surplus on an unwilling market, or a restriction of output for lack of orders. Either way promotes waste, because:

First. A company that secures enough orders at a too low price, in order to keep its mine operating a large part of the time, must mine "easy" coal wastefully, and sacrifice coal that costs high to mine.

Second. The company that is thus cheated of its fair proportion of the orders, because it will not sell below normal cost, is, of course, compelled to work few days in the month. Idle time is costly time. Overhead charges, fixed charges, salaries, pumping, depreciation, go on. Coal

sold at what would be a fair profit, if the mine operated all the time and mined all coal carefully, will now net the operator a loss. Some element of cost must be eliminated. The only resource seems to be to mine "easy" coal wastefully and to refuse to mine coal that is costly to win.

The way in which a radical change in demand and a sudden increase in surplus, with its increase of competition, promoted waste had many illustrations at the close of the Great War. A typical example is furnished by a large operating company in Indiana. It had been operating all its mines during the war, and since the entire output could be sold, even at a low price, it had profit enough so that all its high-cost coal as well as low-cost coal was mined. When the armistice was signed, demand suddenly dropped. The company could not operate all its mines all the time. Selling price was not advanced, production cost was increased. A number of its mines had a considerable acreage unmined at the outskirts of its holdings. This could have been mined profitably by running all the time, but if mined now, it will be at a loss. The mines were dismantled. The coal that was costly to mine was left and irrevocably lost.

(3) *Have Weak Mines Been Made Stronger By the War?*

We have given the financial weakness of many mining companies as one of the causes of waste. Has the war cured this weakness? Many weak companies have been made weaker and many stronger companies are less able to engage in the battle of fierce competition. During the war every mine operator was urged, even commanded, to increase his output to the limit. To get large output he must buy and install more machinery. For this he had to pay from two hundred to five hundred per cent advance over former prices. He was not allowed to sell his coal at a price that would pay off this extra expense during the war. At the end of the war he had a much more costly equipment than at the beginning. If he could make a large enough profit, he might be able in time to cover this extra

cost with the profit. The capacity of production, as we have seen, is greater than demand. He cannot make a redeeming profit against such competition as he will meet. He is confronted with the old, old problem of pre-war times. Will it cost him less to shut down his mine and save his coal, or will it cost him less to pay for mining the coal and give it to the consumer,—or pay him for taking it? If he decides to operate, he reduces the cost as much as he can. High-cost coal will be left in the mine. It may as well be left in the mine as to be recovered at high cost and given away with a bonus. This is not an overdrawn picture, but one which everyone conversant with the coal industry has seen drawn many times. The hundreds of wrecked coal companies, even large, apparently strong companies, in the past testify to the same thing. How can the future do better?

(4) *Will These Causes of Loss Cure Themselves?*

1. The time will come in the near future when no good coal land will be cheap enough to waste. Coal land containing good coal will be dear and hard to find. Any fortunate owner will be unwilling to waste his good coal.

2. The time will come when strong competition between sellers of good coal will cease. The competition will be between buyers, bidding against each other, the unsuccessful contenting himself as best he may with poor coal.

3. All weak companies will be eliminated. Receivers and strong companies will cure this cause. Cost of plant and cost of production will do in the bituminous field what it has already done in the anthracite field.

This day will come, though all avoidable waste and loss are stopped and all possible conservation be secured. An aroused public should not allow useless waste and loss to hasten that "doleful" day.

If what has been said is true, the coal problem is a problem worthy of the most serious thought by the most serious-minded men.

The entire coal field naturally divides itself, economically, into four divisions: (1) Coal land held by the United States government, for the exclusive use of the coal for its battleships and other ships. (2) Coal land held by the government and operated directly or by lease for mining commercial coal. (3) Coal land in the possession of private owners, which needs control. (4) Coal land in private ownership which is now operated skilfully, scientifically, and economically.

CHAPTER VI

GOVERNMENT COAL LAND HELD FOR ITS EXCLUSIVE USE— “NAVY” COAL LAND—BATTLESHIP COAL LAND

Navy Coal Must Be Quick Firing—High in Heat Value—Smokeless—Not Subject to Spontaneous Combustion—Alaska Coal disappointing—Pocahontas Coal Answers All These Tests and Is Standard—Government Should Gain Control of Pocahontas Coal and Keep for Its Exclusive Use—Pocahontas Coal Is Being Rapidly Depleted—Is of Small Area—How Gain Control—How Operate—How West Virginia Be Compensated—How Other Users Than Government Be Taken Care of—Is the Purchase a Good Investment?—If We Do Not Conserve This Coal Our Navy Will Be of Little Use in Time of War.

“Our Battleships Without Fuel.” If this had faced the public in the headlines of our morning paper one morning in 1917, horror and panic would have seized the entire people, and they would have said:

The war is lost without our navy. Somebody has blundered. It cannot be that we have no coal. Stop every car that is moving to any factory, even a car bringing coal to us. We will for a time bear bitter cold and eat uncooked food. Rush every car to the coast, to the collier, to the battleship.

What, if the next morning paper had said:

Our battleships are without fuel because they will not take the only kind of coal we can offer them; our only good navy coal is all gone; we have let everybody use it for every kind of purpose, and now there is none to be had. The only kind of coal that we can offer is poor coal, at least, poor for navy use. The battleship officers say our ships are worse than useless fueled with that poor coal, when pitted against ships fueled with good navy coal. Better dock our ships and save the lives of our men.

Fortunately, no such calamity overtook us. No ships that plowed the oceans were driven with better fuel than ours were. Our “Navy” coal is equal to any coal in the world. We have enough of it to last probably half a century, as it is now being dissipated. If the government is

not intending to own and conserve it, our programme of battleship building ought to be so planned that the last battleship will be junked in half a century. If a battleship is intended to fight, if need be, it will miss its calling if we are at war, at the end of about half a century, with a nation that has good navy coal for its ships.

But we are not planning to junk our last battleship ever.

We are building the greatest battleships in the world. We are arming them with the most powerful guns that they will carry. We train skilled officers and gunners. We install the most powerful engines to drive them. They are fighting machines. Our cruisers are racers equipped to fight. They challenge the swiftest enemy ship to outrun them when they pursue. Fuel them with poor coal, and let the enemy fuel with the best coal, and the race is lost; a slow ship with good coal may outrun a swift ship with poor coal. Our naval authorities recognize the importance of good navy coal. They will accept no other. A well-thought-out scheme of coaling stations supplied with good coal and colliers supplied with apparatus for coaling at sea are as carefully planned as the ships themselves. But this providence, so far, has merely looked to the immediate future. It is doubtful if they have had a thought beyond a year or two of the future. It is, perhaps, beyond their province to look much beyond a year-to-year supply.

But legislators and an intelligent public ought to be awake to the fact that if present conditions and tendencies are not changed, the navy will be without coal or forced to use inferior coal at a time not more than a century, and probably half a century distant.

Our plea for immediate and effective action on the part of our government will fall on the deaf ears of those who do not concern themselves about what will happen after they are dead. But let them plan to live for fifty years, and they will see what I have described, unless government intervenes. It will also have little interest for those who can only think in terms of our limitless "inexhaustible" coal supply.

Even so, it must be remembered that, few of the really good coals, as they are rated, are good navy coal.

A good navy coal must answer these four tests:

(1) It must be quick-firing. It must respond to a sudden demand for more steam and it must not clinker under forced draft.

(2) It must be high in heat value. The greater the heat value of the coal, the greater will be the steaming radius of the ship when it leaves port with its bunkers full, and the greater the efficiency of the stokers.

(3) It should not be liable to spontaneous combustion.

(4) The more nearly smokeless it is the better.

An army using smoking powder would be at a great disadvantage if pitted against an army using smokeless powder. This we found to our everlasting disgrace when we sent soldiers equipped with smoking powder to fight in Cuba against Spaniards equipped with smokeless powder. It is almost as important that a ship's funnel should be smokeless as that the gun's muzzle should be smokeless.

Where is an adequate supply of such coal?

First. A Supply for Ships on the Pacific Coast

The principal supply for the Pacific Coast was formerly shipped around Cape Horn, and now by the Panama Canal, from the Eastern coal fields of the United States. We had hopes that ships on the Pacific Coast would be supplied with good navy coal from the Alaska coal fields when the railroad to those coal fields is completed, and the coal is sufficiently developed. But recent tests made of the coal in actual trial in the ship's furnace seem to show that the coal is not good navy coal. If so, the ships on the Pacific Coast will have to be coaled from the Eastern fields as at present, and will continue their drain upon the Eastern coal. I shall give an account of the tests of the Alaska coal later. To show the importance, however, that scientific and practical men attach to a supply for our ships it is interesting to note what action they took and what opinion they expressed with regard to that Alaskan field

when they assumed that it had good navy coal. Secretary Fisher, when he was about to visit Alaska for the purpose of gaining first-hand information that would help him to determine how to aid in the development of the country, consulted coal men and metallurgical societies, to get their opinion. He asked them whether, in their opinion, the coal land in Alaska ought to be sold by the government or whether the United States ought to retain title to it and operate it, either directly or by lease.

The following resolution was passed by the largest Metallurgical Society in the United States and sent to Secretary Fisher. It embodies the general advice which he received from all sources:

There are now known to exist in Alaska but two relatively small fields containing high-grade navy fuel, and inasmuch as the government now possesses no original source of fuel supply on the Pacific Coast, it is desirable, in the interest of the National Defense that a selected area of these fields be held and operated under the direct control of the government.

Second. Coal for the Atlantic Fleet

All these people were very properly concerned about a coal supply for the Pacific fleet, as the ships will have to depend on imported coal or bring it around from our Eastern coast, if Alaska cannot furnish it. It is not very surprising either that they should not be solicitous about a supply for our greater Atlantic fleet and government ships, for they thought the supply in the East enough for ages. But the resolution passed by the Metallurgical Society, with change of three words, is just as proper for our Eastern fleet.

There are now known to exist on the Atlantic Coast but two relatively small fields containing high-grade navy fuel, and inasmuch as the government now possesses no original source of such supply on the Atlantic Coast, it is desirable, in the interest of national defense, that a selected area of these fields be owned and held and operated under the direct control of the government.

These two fields are the *Pocahontas and New River*

coal field in West Virginia and the semi-bituminous coal field in Central Pennsylvania. When anyone speaks of standard navy coal, however, he is assumed to mean Pocahontas coal. When the Bering River coal of Alaska was being tested for navy use, Pocahontas coal was brought to Alaska and used as the standard.

That the general government acquire and hold this coal, or the largest part of it, for its exclusive use is very urgent.

(1) Pocahontas is the standard "navy" coal of the United States. It is quick firing, of high heat value, is not liable to spontaneous combustion, makes little smoke in burning. During the submarine menace, ships were required to have enough smokeless coal in bunker to steam them through the submarine zone. Geologist I. C. White says of this coal:

Pocahontas coal is an ideal steam fuel, low in volatile matter and high in fixed carbon, while low in ash, sulphur, and moisture. It gives off intense heat with a nearly smokeless combustion. The small proportion of sulphur insures safety from spontaneous combustion on shipboard. So it has become the ideal fuel for steamship and general navy purposes and its use on those lines is constantly increasing.

(2) The Pocahontas Field Is of Small Area

In 1908 I. C. White, State Geologist for West Virginia, estimated the entire area of the Pocahontas and New River fields together at two thousand five hundred and seventy-five square miles. Since that time at least seventy-five to one hundred square miles have been exhausted. If we count an area of twenty-five hundred square miles, or one million, six hundred thousand acres, each acre containing six thousand tons of coal, we find the content to be nine billion, six hundred million tons. If we estimate, with Professor White, the depletion at fifty million tons a year, this coal will last one hundred and ninety-two years. The real Pocahontas field does not cover more than five hundred square miles, or three hundred and twenty thousand acres with a content of one billion, nine hundred and twenty million tons. At the estimated exhaustion of fifty

million tons a year, this coal would last about forty years.

In the Pocahontas field there are but two veins of the lower Pottsville or Pocahontas coal,—named No. 3 and No. 4,—that are of workable thickness. Generally where No. 4 is found, No. 3 is thin or wanting. No. 3, which is the great vein of the field, varies in thickness from two feet eight inches to seven feet.

We can see now the basis upon which the head of the Geological Survey lately made our previously quoted statement. After giving a gloomy forecast of the life of the Pittsburg vein, he said:

When we turn to examine a less nearly exhausted coal field as the Pocahontas, we find that increased rate of output tends to cut down the early and more optimistic calculation of expectancy of life. Expressed in human units, the estimation for the Pocahontas field is cut down from four or five generations to three, or even two.

That is, down to sixty-five to one hundred years.

The Field Is Being Rapidly Depleted

This coal is being sent all over the Middle West. It is in demand in cities in which smoke-prevention is required. It is shipped to steel plants, where it is mixed with higher volatile coals and burned in byproduct ovens. The United States Steel Company burned three million tons of coal in a year, seventy-six per cent being Pocahontas coal. It is carried to the great docks at Newport News and Norfolk, and thence it goes to all points along the New England Coast for distribution in the interior.

In addition to furnishing coal to battleships, this field is supplying bunker coal for nearly all ships plying between this and other countries. Up until a short time ago our smokeless operators furnished little bunker coal. Ships plying between England and the United States bunkered at English ports for the entire round trip. It was thought that American coals were not fit for steamship coal. When England began to limit the amount of coal she could spare from her battleships and ammunition plants, ships leaving

England for the United States took enough coal to bring them across the ocean and got coal here to take them back. Later they took coal here for the round trip.

In addition, ships plying between South America and England now consume twice as much of our coal as formerly and get it at Newport News. They cannot carry enough coal to take them from Newport News to South America for a cargo and across to Europe and return to Newport News, but bunker enough to take them from Newport News to South America and back, then bunker enough coal to take them from Newport News to Europe and back. During the war, on account of embargo on coal from England, the bottling up of Belgian, French, and German coal, the Pocahontas coal was carried to all neutral countries, and before we entered the war was carried to any of the Central belligerents we could reach, and to our Allies after we entered the war. If it had not been for the stress of their need of fuel, Pocahontas coal would not have had so fair a chance to show how good it is. It is very friable, and by the time it has passed a number of handlings, a considerable amount of it is crushed fine.

It is common report that the first cargo of Pocahontas coal exported to Southern France was rejected on the ground that the consignor had sent "slack," or the waste coal of the mines, instead of pure coal, as contracted for. Finally the purchaser was induced to give the supposed "slack" coal a steaming test, where, to his great surprise, it surpassed any coal he had ever used for that purpose.

Now nearly every nation is clamoring for this coal.

The editor of a trade journal is so afraid that we shall damage our reputation, and thus check exportation, that he advocates the absolute prohibition of the shipment of any other than this coal, so that exportation may be rapidly increased. He says:

If we are to build up a permanent export business, in order to meet the competition of English coal, only the premier coals of the country should be permitted to be shipped to foreign

markets. Competition is bound to be keen and it will take the best coal we produce to give us a chance at all. In view of this, it should be the duty of the Bureau of Mines to find out the best coal for the export market. A list should be published of the permissible export coals and coals shipped to foreign ports should be confined to this list.

The editor need no trouble himself conjuring up possible and impossible legal machinery to hasten export of our best coal. That is the kind going into export, and,—more the pity!—our best coal will continue to go in increasing volume, if this exportation is not checked. The ordinary coal-users may not like to be treated as the children of the thrifty mother who sells her good butter and spreads meat-frying on her children's bread. They may not rise up in protest. But it is time for the American people, who not only have pride in our ships but place their firmest trust on them, if the emergency comes, to rise up in effective protest. Another source of unequal drain upon this coal is that the mines are non-union. During the strike in 1919, when union mines were idle, these non-union mines produced almost to full capacity.

How can the United States get possession of this navy coal land? The coal has been sold with the surface to private owners. The coal is theirs and may not be taken from them without compensation. A combination of three ways may be necessary or advisable,—(1) *Purchase from the owner either the coal alone or both coal and surface*; (2) *Purchase from the lessees the leases which they hold*; (3) *Take by condemnation where actually necessary*.

Purchase from the Owners

If the coal in any given case can be mined without damage to the surface, it is better to follow the government's present way of disposing of its coal land, that is, consider the surface and coal separately, leave the owner in possession of the surface and buy only the coal. In this way cultivation of the surface is encouraged. Where mining the coal under the farm is likely to damage the surface, or where the surface is necessary for construction of roads

and railroads, or where the owner does not want to separate coal and surface, then both may be bought.

Purchase from the Lessee the Lease That He Holds

It is said that ninety per cent of the mines in that field are being operated under lease. It is probable that these leases would better be bought. If the lease is for long enough time to exhaust the tract leased, it will not be necessary to buy the landowner's right, as he will, no doubt, be glad to exchange the present lessee for such a good paymaster as the United States,—the more so, as he will understand that the new lessee will see to it that no coal is wasted and the return from royalty will be so much greater from scientific mining than it is likely to be as mined at present.

What of the Equipment and Improvements Connected with the Mines? The solution may involve any one of three conditions:

First. The equipment and improvement made by the lessee. In this case the negotiation for the lease will include the equipment and improvements.

Second. The equipment may have been furnished by the lessor, to be returned by the lessee in as good condition as is reasonable, wear and tear considered. In that case the use of the equipment passes with the lease subject to the same conditions of return.

Third. The equipment is furnished by the lessor, but the United States government dismantles and abandons the mine. It may be that where the whole field is considered, certain mines will be abandoned for one or another reason. It may be better to mine the area being mined by a certain plant from another opening, or its output may not be needed till later. In this case both coal and equipment must be bought, or some other equitable arrangement be made.

The Government May Take By Condemnation Proceedings

It is probable that small occasion will arise for the ex-

ercise of condemnation proceedings. The profits from coal mining have been so small and uncertain for the most part that owners will be very willing to sell at a reasonable price.

Everyone familiar with the coal business knows of large areas of coal land offered for sale. But it may be that some owners may be holding for a high price, or where they know that government wants their coal land, will place the price unreasonably high. In such case the government may have to acquire the land by condemnation. *Is the government exceeding its legitimate powers in taking coal land in that way?* The government takes by condemnation lands needed for arsenals, forts, and army posts. Railroads take land for right of way and confiscate coal for their engines on the theory that they are performing a government function. The government would confiscate coal for its ships, paying the owner for the coal. It must be able to take now the coal which it will sorely need in the future for its ships.

How Much of This Navy Coal Should Be Acquired?

If the Pocahontas field alone be acquired, only about five hundred square miles, or three hundred and twenty thousand acres, containing about two billion tons, will be covered. If the New River field be also included, the area will be probably twenty-five hundred square miles, or one million six hundred thousand acres, containing about ten billion tons. It may be determined to acquire some area between those limits. But it seems wise to consider the entire field, for, as will hereafter be suggested, some parts of the field that are now being mined for export, and some parts now being mined for certain essential purposes, in the Pocahontas field may be allowed to continue, and at least that much should be available for navy use in the New River field.

What Price Should Be Paid for the Coal?

1. A complete map should be made, showing topogra-

phy, roads, railroads already built, together with the roads that will be needed in the development of the field. On this map the holdings of each owner and lessee should be drawn, showing its accessibility, its nearness to a means of transportation to tidewater, the field of development to which it naturally belongs, and its distance from the operating plant through which it will be mined.

2. Make use of the data already collected in the West Virginia Geological Survey, and the logs of the many drill-holes made by coal and oil companies; supplement these with as many tests as necessary, and thus determine the number of veins and the thickness and area of each workable vein in each holding.

3. Acquire each holding, if possible, amicably, by one of the three ways proposed, that is, by purchase of the land, purchase of the lease, or lease of the lease, at a price at which this particular tract is rated in accordance with the general principles that have been adopted for the entire field.

Principles Made Use of in Rating the Various Tracts

1. Making use of the data concerning number, thickness, and area of each vein, estimate the probable average recoverable tonnage from each vein in the tract. When the government was selling its coal land in the West it estimated the tonnage in the land in this way, but counted only one-fifth to one-third of the result in charging for the land. The uncertainty concerning faults and so on was reckoned great enough to warrant such reduction.

2. Fix upon a royalty rate based on distance of the tract from the mine through which it is to be operated. Thus, if the royalty on coal within one mile of the mine is 10 cents a ton, the royalty on coal at two miles distant is 9 cents; and so the royalty decreases by one cent a ton for every additional mile of distance up to five miles. For coal at a distance of five miles or more the royalty is fixed at 5 cents a ton.

3. Estimate the *number of years* it will take to mine

each holding when operated along with other coal with which it will naturally be mined at the same time.

4. Having the tonnage in each tract and the number of years it will last after operation begins, of course the tonnage divided by the number of years will give the average number of tons put out each year.

5. The tonnage put out each year, multiplied by the rated royalty per ton, gives the amount of money the tract will yield each year after it begins to operate. That is, the holder would realize an annuity of that sum from the beginning of operation till the coal is exhausted.

6. Determine as nearly as possible the number of years it will be until operation reaches each tract.

Having, then, the number of years that will elapse until operation begins, the number of years the annuity will run, the equitable price per acre is the *present worth* of given annuity beginning at the end of a certain number of years and running a given number of years. A single illustration will suffice:

Suppose a tract of one hundred acres will be reached in operation in twenty years, and be worked out in twenty years, at a uniform rate of operation. Suppose the estimated tonnage is four thousand tons to the acre, or the entire estimated tonnage is four hundred thousand tons. Then the average yearly output will be twenty thousand tons.

Suppose the tract is three miles from the mine, and therefore the rate royalty is 8 cents a ton. The annuity therefore is \$1600. Now the present worth of an annuity of \$1600 to begin in twenty years and continue for twenty years is \$5280.

Therefore the proper value of the land in this tract is \$52.80 an acre.

How Will the Government Conduct the Mining?

First. Acquiring navy coal land is not launching a scheme to nationalize the coal industry. It is simply contracting for a coal supply for the United States navy for

a number of years, instead of for one or two years. It is contracting with a contractor who cannot be out of coal when the government calls for the coal.

It is exercising the same kind of common business sense that is being exercised by railroads that are buying their coal years ahead by buying the coal in the ground, and exercised by steel companies that lease coal land in a perpetual lease.

Second. *It will operate its coal land under lease*, the government taking all the output for its own use or its own disposal. There are few industries that require such skill in the management as coal mining. Every coal field has problems that are different from those in every other field. Some of the most disastrous failures have come from operators and managers from one field carrying the methods they used in the field with which they are familiar over into the new field, which they do not know. It is a common saying in the West, that an operator from the East takes two years to find out that he does not know how to manage a Western mine. Lessees in this field will generally continue to operate government mines under strict regulation, helpful co-operation, and suggestion, such as I shall outline later. Operators will eventually sell all their coal to the government at a profit not too great, but which will give them a very delightful change, a steady profit instead of their former experience (now a profit, now no profit or a loss), no anxiety about finding a buyer, and no bad debts.

How Will the State Be Compensated for Loss of Tax?

It is a complaint, which has a good deal of force, on the part of States in the West, within whose borders government-owned lands are located, that these lands are leased by the government while the State or the county furnishes protection and improvement such as are given to privately-owned land, and yet the land is not taxed. The complaint would come with greater force, if land that the

state now taxes should be taken by the Federal government and relieved from taxation.

Extreme socialists would maintain that coal belongs to the whole people rather than to the State. But it seems clear that the State should be compensated for the loss of tax that it formerly enjoyed. The easiest and most equitable way is for the government to pay the State a certain royalty on each ton of coal mined, so that the State would get as much from the land now owned by the government as it received, or would have received, if it had remained in private hands.

Suppose for example, that the land taken by the Federal government had been taxed 30 cents an acre, the State received from three hundred and twenty thousand acres taxes to the amount of \$96,000. If the output of coal for the government use is ten million tons a year, one cent a ton will produce \$100,000, or enough and some to spare. If the one million six hundred thousand acres are bought, and the tax is 30 cents an acre, the total amount is \$480,000. Five cents a ton will raise the amount, if ten million tons are mined. This amount of tax will decrease as the coal is depleted. The State will receive tax for a longer time than it would under private ownership, for depletion will not progress so rapidly.

Is This Purchase a Good Investment? Will it Make High Cost for Navy Coal?

It is a good investment even if it made navy coal cost high, which it will not.

1. If only three hundred and twenty thousand acres of the Pocahontas field be bought at \$60 an acre, the cost will be \$19,200,000.

If, as a first adjustment, one million six hundred thousand acres be bought at \$60 an acre on the average, the cost will be \$96,000,000.

A considerable reduction will result from taking over leases instead of buying the land outright. This reduction might be nearly enough to offset cost of equipment. The

larger of these sums is not staggering, as we are accustomed to think in terms of billions.

2. Taking about the average of these two sums, to illustrate, \$60,000,000, the interest charge at first, at four per cent, is \$2,400,000 a year.

If the annual output amounts to fifteen million tons, a charge of from 16 cents a ton at the outstart, running down to zero when the sinking fund pays off the \$60,000,000, will suffice.

3. To provide a sinking fund of \$2,000,000 a year, exclusive of interest, will require a charge of 14 cents a ton on an output of fifteen million tons.

4. If the cost of mining and upkeep be \$2.25 a ton, and the operator be allowed a profit of 50 cents a ton, the cost at the mouth of the mine will be \$2.75 a ton. Add to this the 30 cents for interest and sinking fund, and the coal will cost \$3.05 a ton.

The interest charge will constantly decrease until it becomes zero. The original cost will be paid by the sinking fund in about thirty years. At that time the only cost to the government will be cost of mining, operators' profit, and royalty paid to West Virginia. It will cost more to mine coal in thirty years than it does now, but the increased cost will not be greater in government mines than in other mines.

Can anyone imagine the navy buying Pocahontas coal in thirty years from now, if there is any to buy, at three or four times \$3 a ton, if government does not control its dissipation?

*Is the Government Freezing Industry and the People
for the Sake of the Navy of the Future?*

It will be objected that coal needed in industry and commerce and in the homes, is to be hoarded to the great injury of the public. No legitimate industry will be crippled, no domestic need unsupplied. The New River field was included in our discussion to meet that objection. In parts of the Pocahontas field, and especially in the New

River field, there are veins of coal, other than the Pocahontas coal, which can still be mined commercially. Such veins as the Sewell, Fire Creek, and Beckley, are commercially rated as high as Pocahontas.

To illustrate the use which can be made of these coals to serve the public, and still save the Pocahontas, two illustrations may be given:

1. Coal serving an essential industry.

The United States Coal and Coke Company, a subsidiary to the United States Steel Company, has leased a large area of Pocahontas coal land. The output is sent to Gary, Indiana, and Sharon, and mixed with Illinois and Pennsylvania coal, and burned in byproduct ovens. If, on investigation, it is found that low volatile coal is essential to the steel industry, either of two things may be done:

First. A lease on an area in the New River field equal to the area of the leasehold in the Pocahontas field may be given in exchange.

Second. If it is found that New River coal is as good navy coal as Pocahontas, an area equal to that which is held by the steel company in the Pocahontas field may be set aside in the New River field for navy use, and the steel company may continue to operate its own lease.

2. Export Coal.

As a humanitarian act it will be necessary to furnish coal to Europe until it can adjust itself to the new conditions and has time to develop its resources and supply its own needs.

In a short time, fortunately, there will be no need that we sell our good coal cheap, in order to furnish foreign ships with cargoes, so that their owners may grow rich from their exorbitant freight rates. Until such time as we can see the folly of sending our good raw coal to foreigners for them to save the gas and coke and sell the rest back to us at a manifold price in dyes and drugs, we

can export New River coal. Meanwhile Kanawa gas coal, Pennsylvania, and other coals may help to warm and rebuild Europe and continue, as now, to supply our home needs.

Will the League of Nations and the New Era of "Peace on Earth and Good Will Toward Men" make battleships and navy coal unnecessary?

Our navy and other ships will never be less than at present. Our building programme looks toward a navy equal to that of any nation in the world. A year before the beginning of the Great War, war between civilized nations was declared unthinkable. Warned by past experience, no great nation will again be caught napping. England and France will have need of greater navies than at present, to protect their far-stretching interests. They are now arranging mandatories in the Near East, with a view to protection from assault from without, and not neglecting the possible future time when they will again be enemies. The wider world that has opened up will demand a wider spread of our ships. Our great coast line and our island possessions will never need fewer protecting ships than now.

We conclude, therefore, that the United States Government should at once:

1. Map out and test the Pocahontas field so as to decide how much and what part of it is best fitted to furnish the navy fuel of the future.

2. Acquire this land on terms that are just to both owners and the nation.

3. Adjust the claims of present operators holding lease, and operation should be carried on under government control. The output should be gradually reduced until it is just sufficient for government needs.

CHAPTER VII

NAVY COAL IN ALASKA

Alaska Gives Little Promise of Furnishing Navy Coal—Test Made By Bureau of Mines, on Cruiser Maryland—Seven-day Test in Port—Fifteen-knot Test at Sea—Twenty-knot Test at Sea—Conclusion: Bering River Coal Is Unsuitable for Navy Coal—Test of Washed and Cleaned Coal at Annapolis—Conclusion: Bering River Coal Is Entirely Unsited for Service As a Steam Coal—Three Points Evident in These Tests: (1) Pocahontas Coal Was Always the Standard—(2) Pocahontas Has Qualities Not Shown By Chemical Tests Which Distinguish it As a Navy Coal—(3) Bering River Coal Will Not Help to Relieve Drain on Eastern Coal for Ships.

Alaska Gives Little Promise of Furnishing Navy Coal

I proposed above to fortify my statement that Alaska seems unable to relieve the drain upon Eastern coal for the use of the navy. High hopes were built upon it. During the investigation of Secretary Ballinger, the value of the Alaska coal was very much exaggerated for political reasons. Even honest prospectors have been deceived as to its value. But at present the value of its coal for use in the navy is all that I shall consider.

In 1913, Congress appropriated a sum of money to be "used for the survey and investigation by experimental tests of coal in Alaska, for use on board ships of the United States navy and vessels of the United States." The investigation was carried on under the direction of the Bureau of Mines. On account of the lateness of the season when work was commenced, the investigation was confined to the Bering River field.

R. Y. Williams, mining engineer in the Bureau of Mines, who was one of the chiefs in the work, says that they proceeded

to determine whether or not there existed within these coal fields workable beds of coal suitable for naval use which might

be set aside by the President as a coal reservation for the navy department, and from which the navy could obtain thereafter a supply of high-grade steaming coal for its needs.

Again, he says:

After a thorough investigation of one hundred and fifty surface outcrops and twenty-two tunnels, it was decided that the coal is prevailingly soft, very much crushed and sheared, and that the areas containing coal of a character satisfactory for navy purposes were restricted to not more than three locations.

From these they mined and carried to the coast eight hundred tons, to be used (in what is the only real test) in the furnaces of a navy ship. The *Maryland*, an armored cruiser, of 15,138 tons full-load displacement, was designated to make the tests under the following instructions:

The Bureau desires two complete sets of tests, one to be with run-of-mine Pocahontas coal and the other with Bering River coal. Each set of tests shall consist of:

(1) An uninterrupted period of not less than seven days in port. The auxiliaries shall be the same in both series of tests, equal duty to be performed.

(2) A test at sea with not more than three-fourths boiler power and at a speed of fifteen knots an hour. This test to last twenty-four hours.

(3) A test at sea under full boiler power at a speed of twenty knots. The test is to last four hours.

(a) *Test in Alaska.*

(1) *The Seven Days' Test in Port* is summarized as follows:

Of Pocahontas 94.3 tons were used, and Bering River coal for equal duty 136.8 tons. The Bering River coal is only sixty-nine per cent as efficient as Pocahontas. Neither screened lump, run-of-mine or slack of Bering River coal is equal to Pocahontas for the same duty.

(2) *The twelve hour, three-fourth boiler power fifteen knots test.* With Pocahontas coal ten boilers out of the sixteen were all that were needed to make fifteen knots an hour. With Bering River coal, fourteen boilers were tried, but it was found they could not make enough steam to maintain a speed of fifteen knots an hour, so two more

boilers were added. At the beginning of the run forty per cent of the coal was lost through the grate bars, as the coal was very slack. There was an accumulation of soot and fine ash all through the tubes, and the boilers were dirty. Nine anchor clamps, four end tubes to casing were burned off, one baffle door was warped, and one cast-iron block between center four-inch tubes was burned. The fires clinkered badly, and great quantities of ash were produced. The efficiency of Bering River coal was forty-four per cent of Pocahontas. That is, for equal duty of fifteen knots an hour, 76.6 tons of Pocahontas were used and 173.3 tons of Bering River coal.

(3) *Four hours full power, forced draft, twenty knot test.*

First. Pocahontas.

The twenty-knot speed was maintained with the greatest ease and with little effort on the part of the firemen. There was but little ash or clinker and the boilers were fairly clean at the end of the run.

Second. Bering River Coal.

All boilers were in use, clinkers and ash in excessive quantities were produced. Every effort was made to make a speed of twenty knots, the firemen working to the point of collapse. Constant removal of clinkers was necessary. The average speed was eighteen and six-tenths knots.

Comparative results for equal duty, Pocahontas 79 tons, Bering River 184.7 tons, or Bering River forty-two and eight-tenths per cent as efficient as Pocahontas.

Their statement is:

Bering River run-of-mine is unsuitable for use with forced draft in naval boilers.

The report in conclusion is:

1. The per cent of ash and clinker in Bering River run-of-mine is excessive, merely throwing excessive work upon the personnel.

2. More boiler power had to be used with Bering River coal for equal duty. The difference in coal consumption is too

great to allow a hope for results with Bering River coal that may in any way compare with Pocahontas coal.

3. Bering River coal is superior to Pocahontas in smokeless qualities.

4. The number of miles that can be steamed with Bering River coal with one bunkering is much smaller than with Pocahontas—approximately one-half. That is to say, with Pocahontas coal the Maryland could steam from San Francisco to Yokohama and have three hundred tons in her bunkers, while with Bering River coal she could only steam to Honolulu and arrive with the same amount in bunkers.

(b) *Test at Annapolis.*

Tests of Washed and Screened Bering River Coal.

It was contended by some that the Bering River coal had not had a chance to show what it could do after proper washing and screening plants are erected at the mines. So a portion of the Bering River coal was sent to the United States Engineering Experiment Station at Annapolis to be washed and screened until the remainder should compare equally with the Pocahontas coal. The Bering River coal as mined contained fourteen per cent ash in dry coal and had a heat value of 13.286 B.t.u. Pocahontas coal has five and six-tenths per cent ash in dry coal and a heat value of 14.786 B.t.u. per pound. In order to produce a fuel that was approximately as good chemically as Pocahontas, the Bering River coal was washed and cleaned until it contained 5.42 per cent of ash and had heat value 14.844 B.t.u.; but it required a loss of 49.6 per cent of the original coal, or one-half of it.

After a full test of the coal thus prepared, the expert report says:

In spite of all the refinement of cleaning and washing which reduced the ash content from fourteen and six-hundredths per cent as received to five and forty-two hundredths per cent in the dry coal actually fired, involving in the preparation a loss of forty-nine and six-tenths per cent of the fuel as mined, the highest rate of evaporation was 5.04 pounds of water from and at 212° F. per square foot of water heating surface. Since the operation of the type of boiler on which these tests were made to meet full speed conditions in the service, requires

evaporation of at least eight pounds per square foot of heating surface, it appears that Bering River coal is entirely unsuited to the service as a steam coal, and it is not recommended for use in standard navy grate bars.

From the entire report these three things stand out clearly:

(1) That the only kind of coal which was considered standard navy coal with which the other coals must be compared is Pocahontas.

(2) That Pocahontas coal has in its constitution something which the chemist cannot test, which makes it superior to other coals. Even when Bering River coal was rendered equal chemically to Pocahontas, it was found to be not at all fitted for navy use under forced draft, while Pocahontas coal was a perfect navy coal. The twenty-knot test of Bering River coal gave a striking proof of what would happen if we were at war, and our ship was using even an apparently good coal like the Bering River coal, and the enemy ship of the same class was using as good navy coal as the Pocahontas. If it wanted our ship, it could catch it; if our ship wanted the enemy ship, it could not catch it.

(3) That since Bering River coal is eliminated as a supply for our Pacific ships, the Pocahontas and New River fields will continue to bear the burden of fueling them, and therefore their life will be that much shortened. The conclusion is the more confirmed that the United States should set aside, before it is too late, and reserve a large portion of this coal for its future use.

CHAPTER VIII

GOVERNMENT OWNED COAL LAND LEASED FOR COMMERCIAL PURPOSES

Maximum Area to One Lessee 2,560 Acres—Railroads Allowed 2,560 Acres for Each Two Hundred Miles of Main Line Within a State, and Mine for Own Use Only—Royalty Minimum Five Cents a Ton and Certain Rental—At End of Twenty Years a New Lease—Individuals Can Mine for Own Use Without Royalty—Municipalities Mine for Domestic Use from Area Depending on Population—Dangers of Uncontrolled Mining, Especially By Small Companies That Pay No Royalty—Municipalities Ought to Be Required to Build Byproduct Plant.

For the present the United States government has withdrawn its coal land from sale and inaugurated a new leasing system. The principal provisions embodied in the leasing law recently enacted by Congress are briefly as follows:

(1) The control of the leasing is under the Secretary of the Interior.

(2) The maximum area leased to one lessee is two thousand, five hundred and sixty acres.

(3) "No company or corporation operating a common carrier railroad shall be given or hold a lease for any coal deposits except for its own use for railroad purposes, and no such company or corporation shall receive or hold more than one lease for each two hundred miles of its railroad line within the state, and exclusive of spurs or switches, and exclusive of parts of the railroad operated mainly by power produced otherwise than by steam."

(4) The lessee shall pay to the United States, a royalty not less than five cents a ton, and an annual rental not less than twenty-five cents an acre for the first year, not less than fifty cents an acre for the second, third, fourth and fifth years, and not less than one dollar an acre for each year thereafter; this rental is credited against the royalty for that year.

This rental is intended as a minimum royalty. Thus, if the lease is not operated during any year after the fifth, the lessee must pay the government \$2560 on a two thousand five hundred and sixty acre lease. But if it is operated so that the royalty amounts to \$2560, then there is no rental to pay.

(5) At the end of twenty years, the Secretary may make "such adjustment of terms and conditions as he sees fit."

(6) Individuals, or associations of individuals, may be granted the privilege of mining coal for their own use without royalty.

(7) This privilege shall not extend to corporations.

(8) To municipal corporations the right may be given to "prospect for, mine and take not to exceed three hundred and twenty acres for a municipality of less than one thousand population; and not to exceed twelve hundred and eighty for a municipality of not less than one hundred thousand and not more than one hundred and fifty thousand population; and not to exceed two thousand, five hundred and sixty acres for a municipality of one hundred and fifty thousand population or more. Upon condition that such municipal corporations will mine the coal therein under proper conditions and dispose of the same without profit to residents of such municipality, for domestic use."

Concerning the terms of the leases, it may be said:

(1) The control naturally goes to the Department of the Interior, if we are not to have a Department of Mining. It is well enough, providing it is a real control not only of the leasing but also of the operating to the extent that such control may conserve the coal.

The chances are all against such control. In the first place, it has never been exercised anywhere else, why should it be exercised out away from the places where conservation seemed most necessary. In the second place, the chances are greatly against the Secretary's knowing what proper regulation of mining means.

Taken,—as is generally the case,—from a profession or business that does not require any knowledge of the coal business, and thrust into a position in which myriads of interests confront him, he may well feel that, if it is reported to him that a lease has been made, that settles the matter at least for twenty years.

(2) Limiting a railroad lease in area and to mining for its own use is a wise provision. But if the mining of railroad-*owned* land needs control, much more does the mining of *leased* land by a railroad need it.

(3) The provision authorizing readjustment of terms and conditions at the end of twenty years may invite mining of “easy” coal. If an operator has a lease of two thousand five hundred and sixty acres, each acre containing five thousand tons of coal, and if he mines one thousand tons a day for two hundred days each year, his lease will last sixty-four years.

He does not know what new terms and conditions may be imposed at the end of twenty years. So he plays it safe by mining as much coal as possible, and at the least possible cost, if he is not controlled.

(4) The granting to an individual the right to mine for his own use, without payment of royalty, is a very dangerous provision, if conservation is important. Such scattered operations could not be properly controlled, even if it were the duty of some one to do it. What that kind of mining leads to is illustrated by what it did lead to in the early days of anthracite mining and in such fields as the George’s Creek field in Maryland. Holes were opened on the outcrop of a vein. Coal was dug or gouged out until water became troublesome, or ventilation became bad. The hole was abandoned and a new hole dug. The result was, of course, that the fallen roof made it almost impossible to reopen the vein at the same place. If a drift is opened at another place, there is constant danger of the water that is pent up in those abandoned holes breaking through and flooding the new mines and drowning the men. That kind of disaster has happened. One cannot

help wondering why groups of irresponsible persons should be allowed to mine for their own use, while the same group organized and responsible cannot mine for their own use.

(5) The provision allowing municipalities to hold and mine coal land is not so dangerous as leasing to individuals. It is easier to subject these operations to regulation. But it hardly seems fair to lease to a private company or corporation a tract of land at a royalty, and then take its market from it,—or a large part of its market,—by allowing cities to mine their own coal, for which they pay no royalty, and which they sell to their citizens at no profit to the city. The only way the competing company can get any of the domestic business is by mining “easier” coal than the city is mining.

If this provision had attached to it the condition that municipalities granted such a free lease should burn the coal in byproduct ovens and sell to the citizens gas and coke for domestic use, it would have been admirable for the city. It would conserve coal and also be a source of revenue to the city from the byproducts. It could save gasoline by use of benzol, and furnish sulphate of ammonia to its citizens to fertilize their gardens.

By the control which is suggested here is meant the control that I later suggest for all the coal fields, both East and West.

CHAPTER IX

COAL LAND IN THE HANDS OF PRIVATE OWNERS

Three Parties to Be Dealt With—States Should Co-operate in Conservation—Coal Is a Large Part of the Basis of Their Prosperity—United States Does Now Reach Across State Boundaries and Controls Their Citizens—Coal More Important Than Railroads—Owners Want Relief from Monopoly of Labor and Restrictive Hostile Legislation—Railroads and Steel Companies Should Own Some Land, But Not Mine Commercial Coal.

If the United States now owned the coal land and were starting its coal policy all over again, it would not sell any of the coal with the surface. Its present policy in dealing with its Western coal land shows that. If it had retained title to the coal, and had it operated under the regulations and restrictions we are now advocating, billions of tons of our best coal, which are now hopelessly lost, would have been saved. We can truly say that it could have been done, but we can as truly say that it would not have been done,—and that is the discouraging thought. The government in the leasing policy that it is now launching, as far as appearances indicate, is just moving on in the same old prodigal way. It is easy to sum up the shortcomings of our predecessors and condemn them for waste of our heritage, and by implication say what we would have done. It is a safe pastime to scold the shades of our ancestors for their sins.

However much it may relieve our feelings to berate the coal industry of the past, it will not fill the bins of our descendants. Will they summon our shades to the bar of judgment and convict us of like failure to remedy the evils which we see more clearly than they did? Wise and earnest coal men in convention and at banquets make speeches pointing out conditions that ought to be changed and suggesting remedies. Then they eat their banquet dinner and feel that they have done their best in pointing

out the evils, or they lean back and say: "No man can reform a great industry in which so many people have to be consulted and satisfied,—then, there are Labor and the General Government."

The problem is not easy: vested rights, rights of private property. A man's coal mine is his castle.

The American people have been brought up on these principles. But hard as it may seem, resist if we choose, control of some kind is coming. If a well-thought-out way, devised by the wisest of those most vitally interested, is not the outcome, then an ill-thought-out way, devised by ignorance and selfishness, will come.

There are three parties to be dealt with in the treatment of the subject.

1. *The States in Which the Coal Land Is Situated*

States are naturally and properly jealous of any infringement of their prerogatives. They are quick to resent any action by the Federal government, which seems to control their citizens to their disadvantage, for the sake of advantage to the citizens of other States. The Congress in the recent law authorizing the Secretary of the Interior to lease the Western coal land, recognized States' rights in the proviso.

Provided, That nothing in this act shall be construed or held to affect the rights of the States or other local authority to exercise any rights which they may have, including the right to levy and collect taxes upon improvements, output of mines, or other rights, property, or assets of any lessee of the United States.

But the coal States are the States that are benefited more than any others by any policy which prolongs the life of their coal fields. The coal industry is the basis of a large part of their wealth and prosperity. The coal interest of each State is closely related to the coal interest of every other State, whether that State is seller or buyer of coal.

President Roosevelt, as long as May, 1908, called the Governors of all the States into conference, with a view to a concerted action toward conserving our natural resources.

He felt that it was a great subject which affected every state, and that it is the duty of all the states to co-operate with each other and with the Federal government in conserving and properly using our natural resources.

2. The Federal Government Interest

The Federal government represents the whole people. It must act in a constitutional way but it must act, if any vital interest that concerns the whole people is involved. It is incumbent upon it to find a way,—a just but effective way. We have come more and more to realize that we are a nation,—a just and righteous nation but a vigorous one. When we were at war the whole people were at war. It did not need that any State should declare war. Every resource that was useful for the government was taken anywhere, in its own way. State lines are not Chinese walls, to shut in a commodity which is needed in another State. No tariff wall separates State from State. The general government reaches out into the States and collects internal revenue tax, income tax, and excess profits tax.

It thus takes from a citizen of a State what he claims to own, the product of his farm, or factory, or mine, produced by his own toil or skill. Railroads chartered by the States engaged in interstate commerce are held to be doing a business so vital to the whole people, that they are performing a Federal government function. When returned to private ownership after they had been taken over by the government, they were given back in a co-ordinated form different from their original form. They have the wages of their employes fixed, they have their freight and passenger rates fixed, the income for six months guaranteed, the amount of dividend on their stock is limited, and a portion of their earnings is taken from

the prosperous roads and given to the weak roads, or to the general government.

Fuel (of which coal is chief) is, if possible, more important than railroads, and deserving of as much consideration. A railroad, if destroyed, may be built again, but coal destroyed can never be renewed. The destruction of all our railroads would be by no means as disastrous as the loss of all our coal.

3. *Owners and Operators of the Mines and Coal Lands*

Operators have for years been hoping for some helpful aid that may bring order out of the chaos of the past. Any operator who says: "Things are all right; just let us alone," is to be suspected. Operators and owners of mines long for the time and the way in which they can earn a reasonable profit on their investments of money, work, and brains. They wonder if the time will come when they may escape the crushing between the nether and upper millstones of union labor and legislation.

First. The Nether Millstone of a Monopoly of Labor.

In several states, and a large part of others, the operator cannot employ any other than union labor. If a non-union man is employed all the union men will quit. And not only will they quit but they will do all in their power, even to the extent of the use of violence, to prevent any others from working. Having a monopoly of labor, they are able to enforce their own terms as to wages and time of work. Every new scale is an occasion for a strike or an advance in wages and more burdensome concessions. Unless the operator can sell his coal at such advance in price as to cover the added cost, the new costs eat up his already too narrow margin, and often bring serious loss.

Second. The Upper Millstone of Legislation.

1. State legislation to perpetuate union control of labor.

In Illinois it is unlawful for any man to engage in practical mining unless he has had two years' experience in the mines of the *State*, and has a certificate from a com-

mission made up largely of practical miners, and of course union miners. It is evident that none but union men can get a certificate. No other could have acquired the experience demanded. It would do a non-union man no good to have a certificate, as he would not be allowed to work anyway as non-union. It seems, also, that the law is so framed as to shut out skilled men from other States who would be willing to work during a strike, as they have not had two years' experience in Illinois and have not its certificate.

2. State legislation requiring operators to pay shot-firers to provide washhouses, to pay workmen's compensation.

These are proper laws, but add to the cost of production. It is rendered harder to increase selling price to cover these increases in cost of production by such federal laws as:

3. Sherman Anti-Trust Law. This law is a constant menace to operators who even think of agreeing on a price that will pay a profit, or limiting production to actual demand, or setting up a common selling agency so as to reduce selling expense.

4. Federal legislation compelling railroads to accept switches to new mines and pay for the switches indirectly, even when it is known that no new mine is needed and that its output will be just so much added to the already overproduction and so much more to ruinous competition. Thus there has been constant increase in cost of production and constant restraint, and constant fierce competition that prevents the operator from covering his new costs by advance in selling price.

Third. Attitude of Operators Toward Helpful Federal Control.

The attitude of operators toward proper government help in correcting present chaotic conditions is well expressed by George H. Cushing, in a recent speech on "Federal Control."

The following are some extracts :

I have a keen recollection that throughout all the years I have been associated with the coal industry, there has been a constant demand that the federal authorities extend some extraordinary protection and aid to coal. Since we have endured a year and a half of government regulation, many coal men say now that they were mistaken all the while. Rather than its being true that coal men have reversed themselves after this experience with the fuel administration, they stand where they always stood. They need, they want, and they must have help. Our objection is not to Federal or government interest in the coal business. It is wholly to the objectionable manner in which that interest expressed itself. What coal men have really wanted through all these years was that competition in coal should be made comparable to the competition in other commodities. It has never been that, it is not that now. The producer in steel has to compete only with those who can get their portion of the limited supply of iron ore. The producer of shoes has to compete only with those who can get their portion of the fixed supply of leather. Even the producer of clothing has to compete only with those who can get a portion of this year's crop of flax, wool or cotton. The producer of coal has to compete not alone with those plants already organized, but with all those who can at any moment open coal mines into the supply of coal that is available for the human race for all time. In this respect competition in coal is not comparable to the competition in any other line of business. I believe we can safely say that—by legislative action if necessary—we as a people should set out to hold the reserve coal land until it is needed. Thus would the competition in coal be made comparable to that in other lines of business. Whether we wish to recognize the fact or not, it remains true that coal has, in public opinion, been classified as being among the public utilities, concerning the affairs of which the people themselves are going to have a word to say. It must be for some one to think out and suggest the proper line of co-operative action as between the industry and the government.

We have "thought out" a line of action in reference to the semi-bituminous or navy coal in West Virginia, and there remains the rest of the great bituminous field. Especially are we now considering the coal lands in Pennsylvania, Maryland, Ohio, Indiana, Michigan, West Virginia, Kentucky, Tennessee, and Alabama.

If we neglect the fact that these lands are in the various States, and assume that a way can be found by which the States and the Federal government will co-operate in full accord, we have to deal as a unit with four classes of owners; (1) Railroad owners of coal land; (2) corporations engaged in manufacturing essentials that bought coal lands from which they are getting their present supply and which assures them of a supply for an estimated time in the future; (3) corporations mining commercial coal either from their own or leased land; (4) individual owners, including those who have bought land and are holding it *en bloc*, as well as farm owners.

Coal Land Owned By Railroads

Railroads should not be permitted to operate a commercial mine.

There is very considerable opposition to railroads owning any coal land at all. This opposition has been created and fostered by railroads owning commercial mines and the oppressive use they have made of the mines. When Congress started on its drive to correct the abuses charged against the railroads, they fixed upon giving of rebates and rate discrimination. This was bad enough, but not nearly so bad as discrimination in car supply. This was a form of oppression that it was impossible fully to destroy. The various State commissions and the United States Commerce Commission tried to remedy it. They ruled that a railroad should furnish cars to each mine on its line in proportion to its rated output.

But when times were dull, prices low, and there was little demand, the tracks of the independent mines were filled with cars they could not use, or which took them a long time to use. Then, when demand was great and prices high, the independent mines had no cars, or cars for only part of a day. They were told they had been furnished their quota. The cost of what they did produce was high and could not be sold at a profit. The railroad

owned mines were supplied with all the cars they could use.

The effect was twofold:

First. The railroad coal had the market to itself when prices were high and the mines made money.

Second. The independent mines were idle when prices were high, and losing money when prices were low, and were forced into bankruptcy and bought by the only company that could risk the purchase, that is, by the railroad, and that at a ruinously low price. So strong became the complaint of the abuse that the roads made of their right to sell coal in the market that Congress passed a law which, it was supposed, would fully cure the abuse.

It allowed railroads to own coal land and mines, but it forbade them to haul coal owned by them except for their own use. But this is practically evaded by the railroad's selling its coal to a company owned by itself. It amounts to the railroad's owning the coal just before it starts on its journey, not owning it while on its way, and then owning it when its journey is over.

A railroad that mines commercial coal and sells even indirectly in the market has the ability, and it is charged exercises it, of doing two wrongs.

(1) Use its commercial coal to compel operators to sell coal to the railroad even below the cost of production. Thus, if the coal land of the railroad is at one end of its line and its output is not enough to meet the railroad's requirement, or it prefers to buy the coal it needs at the other end of its line, instead of mining its own coal and hauling it to the other end of its line, it offers to buy coal at a very low price. If the operator does not accept its offer, it ships its coal (through the agency of its subsidiary company), sells it in the market at the low price, breaks the market, and buys its year's supply at its own price. It indemnifies itself, of course, for any small loss it suffered by getting a year's supply at a bargain.

(2) Using its coal to force sale to itself of a desirable

mine by indirection. The railroad wants to own a certain valuable mine on its line. It contracts for and buys its entire output at a fair price. As soon as the former customers of this mine have made contracts with other companies for their supply, the railroad suddenly ceases to take any coal from the mine from which it had been taking its entire output. The mine is left without customers for its coal. The condition of the company owning the mine is known beforehand by the railroad, and the occasion shrewdly timed. The company is forced into bankruptcy, or is forced to sell to the railroad at its own price.

(3) It is good policy for a railroad to own coal land.

Railroads are essential to the business, almost to the life, of a nation. Coal is essential to the life of the majority of the railroads now, and to all of them in the long run. It is, therefore, dangerous for a railroad to be compelled to stand helplessly still and see all the coal on its line, or in its immediate vicinity, mined and sold. It ought to be able to own an area of coal land sufficient for its future supply for a reasonable time. While this is true, the extent of that ownership and its use must be regulated by some authority, as by the Interstate Commerce Commission. This control should be directed to three things:

(1) The railroad shall not by its lessees, or directly, or through a subsidiary company, sell coal in the market. This might not preclude different roads from exchanging coal that may in certain events be more convenient and reduce a length of haul.

(2) The railroad shall not own a larger area of coal land than is its proper proportion in the field in which the road is located. That is, the railroad shall not buy so as to menace the coal supply of the zone for other legitimate uses, such as for domestic use. And it must not own land held purely for speculation.

(3) Its coal should be mined under the same control as that described later as applying to all coal lands in that field.

Corporations Which Make Essentials and Which Secure a Future Supply By Buying Coal Land

Such corporations as the United States Steel Company and the Jones and Laughlin Steel Company are buying large areas of coal land. The United States Steel Company has large areas in Pennsylvania, Illinois and Indiana. It has large areas in West Virginia, which it has leased and is operating by a subsidiary company. Little can be said against the use it is making of its coal. It is taking it to Gary, Indiana, and mixing it with a sturdier coal from Western Pennsylvania and Illinois, to make coke, and is saving byproducts of sulphate of ammonia, benzol, toluol and gas. The West Virginia coal it is using belongs to the Pocahontas field, and is included in the navy coal reservation. We have already said that the navy reservation is made large so that reasonable exchange may be arranged after careful consideration of the whole field. Steel is necessary for railroads. They must have steel rails, steel cars, steel bridges, and steel for station construction. Not every coal is good coking coal. The coking coals are being depleted, to be burned in various uses for which a non-coking coal is almost, or quite, as satisfactory. So it seems that steel companies are wise in securing and holding a proper area of coal for future use. Steel companies ought not to be allowed to mine coal for any other than their own use.

Strong steel companies will not have any disposition to mine coal for sale, in general, but, if so disposed, they might sell their coal for a time at a low price, in order to break the price of coal that they want to buy, either to supplement their own output or to save depletion of their own coal land. Of course they can recoup even a temporary loss on their coal sold in the low price which they get on the large amount they buy. Their land should,

of course, be subject to the same regulation as to methods of mining as we propose for all other coal. Neither ought steel companies to be allowed to own an area of coal which is out of proportion to the area of coal needed for domestic uses.

Corporations Which Operate Mines for Commercial Sale

These are operated either by their owners or under lease. After deducting the Pocahontas and New River field, the anthracite field, railroad owned land, steel company land, there remains a large area owned or operated by corporations, or that is in the hands of private owners.

We have seen that there has been great waste in mining and using coal in the past and that some of the same conditions as before are returning. We believe that the people demand some change in the management of this essential held in trust for them. The industry is appealing to the government for relief and some helpful control. The operators and owners will welcome a wise solution which will stabilize their business.

CHAPTER X

TO WHAT DEPARTMENT DOES MINING BELONG?

Secretary of Mining and Transportation Desirable—Both Need a Friend at Court: Coal Needs Protection from Railroads—Coal and Railroads Co-operate in Zoning—If not a Secretary, Then Federal Commissioner of Mining—Divide Coal Field Into Districts—Inspect Each Mine and File Records—Use the Records in Fixing Zones, Prices—Help to Be Given to High Cost Mines, in Compelling Complete Recovery of Coal.

First. Shall There Be a Secretary of Mining and Transportation?

Many believe that the great coal industry is entitled to a Cabinet Secretary. Labor has its Secretary, Agriculture has its Secretary, surely Coal Mining is of enough importance and is enough in need of government care to be given a Secretary.

If coal mining is to be joined with any other industry, its logical mate is transportation. Other industries, as agriculture and manufacturing, furnish freight to the railroads, but coal not only furnishes a very important part of their freight, but supplies the fuel which drives the engines and trains.

1. Coal Mining Needs a Friend At Court

"Transportation needs a friend at Court," was the summing up of the vigorous argument made recently by Robert S. Lovitt, President of the Union Pacific System, in favor of a Secretary of Transportation. Most assuredly coal can join him in a like plea. A considerable part of his arraignment of railroad conditions can be endorsed by coal men, if we substitute "coal" for "railroad." He says:

Than the railroad business none is more vital to the very life of the nation, yet neither in the President's Cabinet nor anywhere in the vast machinery constituting the Government

of the United States, is there an officer of any kind or description whose duty it is to look after its interest, to defend it, to speak for it, or to say a word for Justice in its behalf. Running through the statutes of the books of Congress, there is a purpose to curb and repress, unrelieved by helpful, constructive, encouraging provision.

2. *Advantages Arising from Joint Control of Coal and Transportation*

(a) *Protection of coal from railroads.* Railroads consume part of the output of the mines. In the past railroads have taken advantage of their control of car supply and of the desire of a coal company to have a steady customer in a railroad, in order to beat down the price of their contract coal. Railroads have often bought their coal below the cost of production. The danger of having divided control was illustrated when railroads were under Federal control. The Railroad Administrator tried to force coal companies to sell railroad coal at a lower price than other consumers had to pay, in order that the railroads might show low operating cost. If he had succeeded, the coal companies would have been ruined, or they must sell coal to the other consumers at a price greater than a fair price, in order to cover loss on the coal furnished to the railroads.

(b) *Co-operation in storing coal.* Later I outline a plan for making coal a less seasonal industry. To this end, the co-operation of coal companies and railroads is essential.

(c) *Co-operation in zoning the coal industry.* If coal mining is to be zoned, railroads must confine the freight in coal to the zone in which it originates, except the special cases in which crosshauling is allowed. In short, if a controlling force, friendly to both railroads and coal, regulated both, more uniform mining conditions would be promoted, much of this complaint and recrimination, es-

pecially about car service, which is constantly heard now, would cease.

Second. *A Federal Commissioner of Mining in the Interior Department*

Coal mining is itself broad enough and complex enough to require the care of a department.

Transportation might well be under a department. But railroads are now under the Secretary of the Interior, and part of the coal is under the same department.

In determining what can be done, or ought to be done when the rest of the coal land is brought under control of that department, we shall have to be guided partly by what has been done with other subjects brought under the same regulation. We can get some hints in what has been done in setting up machinery for railroad regulation in regulating coal leasing, and the survey of the public lands law establishing Federal Control of coal in the United States. A skeleton of such law may be outlined as follows:

1. There shall be established in the Department of the Interior an office to be denominated The Federal Mining Bureau, whose duty it shall be, under the direction of the head of the department, to superintend, execute, and perform all acts and things touching the mining and using of coal as are now directed by this law, or which hereafter shall be assigned to the said Bureau.

2. The executive duties of said Bureau shall be vested in the Federal Commissioner of Mining, who shall be appointed by the President, by and with consent of the Senate.

3. The Commissioner shall divide the entire coal-mining fields of the United States into Districts. Each District shall, as nearly as possible, consist of a single coal-mining State.

In each District shall be established an office, situated as nearly central as possible, preferably in the capital of the State which constitutes the District.

4. An Assistant Commissioner shall be appointed by the President, with consent of the Senate, for each Sub-District. He shall be charged with the executive duties of the district to which he is appointed.

5. In the District office shall be employed such clerks and other employees as the Assistant Commissioner shall find necessary for the proper conduct of the business relating to the district. There shall be kept in this office all the reports of the Inspectors, maps of the various mines, and such other records as are made for the proper discharge of the duties of the office.

These records are solely for the use of the Commissioner in making his rulings, and are not open to general inspection in such way as to advertise either the favorable or adverse condition of any mine. Of course, each mine record is open to the Officers of their own mine.

6. Inspectors shall be appointed by the Commissioner. They shall be men familiar with mines and mining, especially in the district in which they are to act. They shall be mining engineers who have been trained and fitted both by education and experience in the mining industry, or superintendents of experience who have had such training as will fit them for the duty required. These Inspectors shall be sworn officers of the government, and shall also certify every return under oath.

7. *Duties of Inspectors.* As rapidly as possible, each mining operation in each district shall be thoroughly inspected, especially with reference to these facts: (1) Present and prospective percentage of recovery. What coal is being left at top or bottom; what amount of pillars are being left undrawn, without any intention of recovering the coal. What coal along abandoned limits of the acreage is being unwon. (2) How much and what part of the lost coal might be recovered. (3) Estimated cost of recovering any coal that is now being abandoned, compared with the normal cost in the same mine.

8. *Other Data to be Secured.* (a) Actual capacity output for each mine in the district.

(b) If possible, actual output of each mine for as many years as it has been operated.

(c) Cause of the low or high proportion of actual output to capacity output.

(d) Map showing location of each mine and its record.

(e) Cost of production in each mine, if possible.

(f) Consumption of coal in each portion of the district.

The principal uses to be made of these data are:

(a) Cost of recovery of any coal which is being lost because it costs too much to win it, is estimated for use in a plan of government help in such recovery.

(b) Location of mines and location of consumption and actual output will be used as a guide in determining bounds of zones.

(c) Capacity of mines will be used to determine when any new mines may be needed.

(d) Cost of production may be used in fixing selling prices.

Having now a Federal Mining Bureau, charged with the duty of collecting information and data concerning the coal industry, and making use of such information in encouraging, helping, regulating, and restraining where necessary, we must next consider some things which ought to be done for each of the classes of coal land.

(1) Coal land operated for the government for its exclusive use.

(2) Coal land owned by the government and leased for commercial use.

(3) Coal land held by private owners, which needs regulation in mining coal and using coal after it is mined.

(4) Coal land held by private owners, which does not need regulation in mining but probably in selling-price of coal.

CHAPTER XI

HOW THE BUREAU OF MINING WILL CONTROL THE MINING INDUSTRY

Coal Land Operated for Government Use Exclusively—Leaseholders—Majority of Going Mines Are Leased—Buy Lease and Equipment—Buy Coal Land Continue the Lease—Lease the Lease—Coal Land Not Now Operated—Buy and—Hold Until Needed, Then Lease—Coal Land Owned By the United States and Leased for General Market Coal Land Held By Private Owners—Stop Avoidable Waste—Prevent Opening of New Mines Until Needed—Zoning the Coal Area—Objections to Zoning—Industries Dependent on Coal Outside of Zone—Furnaces Adapted to Outside Coal—Operators Lose Outside Customers—Advantages of Zoning—Reduction in Freight Cost—Protect One Zone from Surplus in Other Zones—Better Car Supply—Centralized Selling and Distributing Agencies—Advantages: Reduced Selling Cost—Better Distribution of Orders—Price Fixing in Zones, Difficulty—Protect High-Cost Mines and Still Not Give Low-Cost Mines Excessive Profits—Government Help to High-Cost Mines—Objection to Subsidy—How Money for Bonus Will Be Raised—Seasonal Character of Coal Mining—Hardship to Operators—Hardship to Mine Labor—Increases Car Shortage in Winter—How Partially Cure Seasonal Character—Voluntary Co-operation of Consumers in Storing in Summer—Coercion on Certain Other Consumers—Railroads, Preferred Industries, Federal, State, and Municipal Concerns Required to Store in Summer Two Months' Winter Supply More Than at Present—Reduces Output from November 1st to April 1st By Forty Million Tons, Increases Output in Summer By Forty Million Tons—Makes Possible Reduction of Mine Labor Twenty Per Cent—Reduce Exports to Lowest Possible Limits—Export While there Is Need to Prevent Suffering—Reduce Canadian Export to Exchange—Foreign Nations Soon Not Need Our Coal—We Sell Our Best Coal and Buy Back Its Valuable Contents—We Sell Our Navy Coal and Reduce Our Navy to Second Class.

First. Coal land operated for Government use exclusively

The "Navy" coal land is now neither owned nor controlled by the United States. To acquire this coal land

will require an Act of Congress, either authorizing the Secretary of the Interior to acquire these lands in such manner as he finds best, or in such way as the Congress will prescribe.

The Secretary of the Interior will refer the matter to the Federal Bureau of Mining for information upon which to act. There will be two classes of owners to be dealt with:

1. Leaseholders. A great majority of going mines are being operated under lease. Every leasehold will be thoroughly examined by the expert inspectors to determine its value and whether it is being operated in a way to meet the government requirements, and if not, what change in equipment and method must be made to start it to mining according to that requirement, and the immediate cost of that change.

After the examination, the government cannot retire and refuse to take the lease as an ordinary buyer might. The government must have control of all the coal.

The government representative may proceed to do one of three things. 1st. Buy the lease and equipment, if the lessee wants to sell or is not a proper person to continue the lease. 2nd. Buy the coal land and continue the lease under Government control, with exclusive use of the output. 3rd. Lease the lease. That is, the lessee continues to operate the lease, but binds himself to operate under government regulation,—the coal to be exclusively for government use or government disposal.

The capacity of the mines now opened exceeds government needs, or soon will, since commercial coal will gradually cease to be mined. This fact may necessitate temporary closing of some mines. Other mines may be abandoned because they are not well located, and the territory may be better mined from another location. Such cases should be dealt with justly,—indeed, generously. Some disappointment to operators will be caused, and some resentment. The vital importance to the government is the only justification for some things that will be done. Hence,

the parties concerned should receive full compensation. Cases of hardship, however, will be rare.

2. Coal land not being operated but reserved. Navy coal land not under lease will be bought as explained in a previous chapter, then outlined into units, each of which can be best mined as a single operation. For some time few or none of these will be needed for operation. When the time comes for offering a unit for lease, it is let to the *best* bidders. It is not so much, if at all, a bidding in amount of royalty, but a bidding by the essential offer of experience and training, of skill and character, and financial strength, which will enable him to conform to the strict Government requirements of equipment and method, which will conserve both life and coal.

The coal is so valuable that, as nearly as possible, complete recovery should be attained. Economy in cost of production, and mining done with all possible skill to that end, is desired, but the maximum recovery is a paramount consideration.

Second. Coal land owned by the United States and leased for Commercial Mining

The present method of leasing has been already given. The lessees should be regulated by the Federal Commissioner of Mining, as we have outlined that control for land in private ownership. Provisions should be inserted in each lease securing complete, helpful regulation by the Bureau of Mining. This regulation may be made the more complete and helpful as the government has now a free hand, and should be able to embody all suggestions that experience has taught us.

Third. Coal land held by private owners

Some of the reforms which The Federal Bureau of Mining will introduce, or some ends toward which it will work, are as follows:

1. Stop useless and avoidable waste in mining. The inspectors reports show that certain mines are leaving coal

at the top or bottom of the vein, that pillars are undrawn without intention of final recovery.

If the report shows that recovery of the coal that is being left is absolutely impossible, then nothing farther can be done.

If the reports shows that the coal can be recovered, then it must be recovered.

If the report shows that a mine is to be abandoned, the company must be required first to get a certificate from the Commissioner authorizing such abandonment. Such certificate will not be given until inspectors report that all recoverable coal in the mines and at the outskirts of the company's holdings has been taken out.

If the reports of inspectors show that winning such coal will increase the cost of the entire output so that it cannot be sold at a profit at the price current in that field, then the Commissioner shall decide what help if any shall be given as I outline under the subject of price fixing.

If the report shows that a lower vein is being mined in such way that an upper valuable vein is being wrecked, the Commissioner must demand that steps be taken at once to so support the roof by props, or flush the lower depleted area, that the upper vein be saved; or that the upper vein be worked first; or failing all these the mine be temporarily closed until means are devised to save valuable coal.

These seem drastic measures. It seems hard to the "every mine is the owner's castle" people that the public should meddle in private business, in order to save coal for itself.

If it be hard it is necessary. Courts often take the management of a man's estate from him when it is shown that he is not mentally fit to manage it and is wasting it to the damage of his heirs. After the operator stops complaining of the unwarranted interference on the part of the government, he will congratulate himself that he was saved from himself, when he realizes that the saved vein of coal is now as valuable as the vein he was first working.

2. Prevent opening of new mines till needed. There is no hardship against which operators have so constantly complained as against the ruinous competition and price cutting that comes from new mines whose product gluts an overloaded market. As long as a mistaken public opinion exaggerates the profit in coal mining, some misguided man or company will open a new mine. As long as large acreage is offered at a cheap price, "competition in coal mining will not be comparable with competition in other industries."

As the present capacity of the mines is far greater than necessary to supply the demand, except in extraordinary cases, no new mines will be needed for years. This restrictive regulation will, of course, be exercised in a practical common-sense way. Thus, an exception might be made where a company has unmined acreage that cannot be mined from its present shaft. When the present mine is abandoned, a new one might be allowed in which to use its unused machinery.

Exceptions might be made where there is a small area, as on a hilltop, or where the coal is needed for local use. This should be guarded and inspected, to be sure that this temporary mining does not damage other coal. Much of the waste and damage to the coal in the primitive mining in the anthracite and some bituminous fields came from the crude mining methods of the small mining companies.

The fact that a large part of the Pocahontas and New River coal will be withdrawn from commerce will, to the extent of probably 20,000,000 tons or more, reduce the competition in the commercial coal. But the stoppage of waste in burning, and the increase in gas producers and byproduct plants will enable a smaller coal supply to do the work now done by the larger amount of coal. It may be that the increased efficiency of the coal produced will keep pace for years with the increased demand from increase of population. These restrictions are not made for the purpose of limiting the necessary use

of coal, but that overproduction which provokes waste, may be controlled.

3. Zoning The Coal Area. The proposition to zone the coal industry is not new. The advantages of some kind of zoning are too patent to escape the thought of intelligence and judgment. "Carrying coals to Newcastle" is the essence of folly. Cross-hauling is too wasteful and costly. For A to send coal to B, then B to send the same kind of coal back to A seems absurd.

The time to try the experiment never came until it was forced upon us by the exigency of war.

Most operators, probably all of them, without giving it serious thought, declare that zoning during the war was worse than a failure. It violated the rights of operators,—was burdensome and wrong.

No doubt there were numerous details in the zoning during the war that were burdensome and wrong. This was unavoidable in a zoning made offhand, with imperfect knowledge, and having many of its features determined by the efforts to prefer industries essential to winning the war.

In time of peace a zoning will correct the mistakes and right the wrongs of wartime zoning. Now no industries are preferred: all legitimate industries are peace industries. No zone boundaries will be drawn offhand but fixed from the vast amount of information gained during the war.

The boundaries will be flexible and gradually adjusted as experience justifies change. As time goes by and conditions change, the limits may also change.

Objections That Are Made

(a) Certain industries are dependent for success on coal outside of their zone. For instance, a certain plant in Indiana cannot make the coke it needs unless it can get coal from Central Pennsylvania to mix with its local coal. In such case a small amount of coal may be allowed to be imported from one zone into another,—at least temporarily.

New methods and new construction of coke ovens may make it unnecessary to use any other than local coal.

(b) Certain plants have furnaces adapted to coal outside of their zone and cannot efficiently burn local coal.

A certain common-sense adjustment will be necessary, but in a short time such matters will adjust themselves. The saving in cost of coal and a sure supply may warrant some expense in making needed changes, and replacements will gradually solve the problem.

(c) Operators who have customers outside of their zone may complain that they have built up a trade outside of their zone at expense of time and money, and now it is arbitrarily taken from them.

Here we have two cross-objections curing each other. Operators in all zones will have customers in their zone who are in the market for a new source of supply,—probably only too glad that they can get their coal near at home with smaller freight rate and a more certain supply. Operators simply swap customers.

These objections will be gradually removed and the advantages will be found to far outweigh the disadvantages.

Advantages of Zoning

(a) A great reduction to the consumer in freight rate. A great part of the cost of coal to the consumer is in the freight cost. The price of coal is (for instance, at the mine in the Pocahontas field), say, \$4 per ton. The freight from the mine to Chicago is \$2.70 per ton.

(b) The producer in one zone is protected from the surplus coal in another zone. If one zone has a surplus of coal by operating its mines steadily, it cannot send its surplus into another so as to reduce running-time in that zone.

(c) Better car supply. Cross-hauling requires many more cars than are really needed. A car starts from the Pittsburgh field with a load of coal for Kansas; it takes it several days to go and return. All the time consumed by

the car in traveling from the Pittsburgh zone to the limit of the proper Kansas zone and back is so much time lost, and so many ton-miles added to the freight cost. This wasteful hauling reduces the car supply in the Pittsburgh zone, instead of keeping it in its own zone and using it over and over again in supplying local demand. The zoning in the United States during the war saved millions of ton-miles, which was equivalent to adding many cars to the car supply.

4. Centralized selling or distributing agencies. Two results are attained by centralized selling agencies:

(a) Reduced selling cost. Every year the cost of mining has increased, and it will continue to increase in the future. Thinner and deeper veins, longer haul in the mines as they grow older, and greater labor cost will cause greater cost of coal. Every available means ought to be employed to offset these increased costs. It is a great waste of energy and money for every mine or company to have all the selling machinery which would be sufficient for all the selling force of the entire field. It is also a great waste of the patience of the buyer to have to stand the siege of salesmen from most of the mines in his district. The reason that the Sherman anti-trust law forbade such agency was to prevent a combination of coal companies to fix prices. "The more salesmen the better." Clearly, the greater the number of salesmen the greater the cost of the coal to the consumer. If a buyer here and there is benefited now, he will pay for it some time in the future and some other buyer will pay for it now.

(b) Better distribution of orders. If possible, the orders for coal in a zone should be distributed so that each mine will get its equitable quota of business. Discrimination in car supply has wrecked many a mine. The Interstate Commerce Commission and the State Commissions had to take this evil by the throat, and they have done much to kill it. The theory of their activity is that every mine ought to have its due quota of opportunity.

Cars without orders are a delusion and a snare. If the operator has cars and no orders, and does not operate his mine, the idle cars are counted against his quota of cars, and when he secures new orders, having used up his quota, he gets no cars. If he is tempted to operate without orders, he may send his coal on an unwilling market and to car demurrage.

This evil the distributing agency tends to remedy. The order for coal comes to the agency. They have the information needed to tell them what mines are sold up and what mines have no orders. A very important additional function is to give the order to the mine producing the kind of coal asked for. The orders are distributed, also, as much as possible, with reference to the least expense to the consumer.

Other things being equal, the coal ought to go from the mine nearest to the consumer, so as to save freight costs and also increase car supply. If such plan shall even in part accomplish these purposes, it will promote economy, stability and Justice.

5. Price fixing in the various zones. Restraining laws passed by Congress, are, for the most part, intended as price-fixing laws: the Sherman Anti-Trust Law was passed on the theory that if certain combinations and understandings between operators are allowed, prices will be advanced much beyond what the consumer ought to pay to cover costs and a fair profit.

Such restraining laws are to that extent price-fixing laws. If legislation can indirectly control prices, why not directly control them?

If joint selling and distributing agencies are allowed, in order to offset that grant, a restraint ought to be put upon profiteering to the injury of the public, and upon privateering and piracy, which will as surely work harm to the public in the end. If high wages and high cost and a fair profit fix a maximum selling price, why should not

high wages and high cost and a minimum wage fix a minimum selling price to stop piracy and privateering?

Difficulties Attending Price Fixing

A just selling price must include cost and profit. It is hard to determine cost in any extended field, as every field has problems peculiar to itself. This difficulty will be partially obviated by zoning. Conditions in a zone will be more nearly equal within its limited area. A new difficulty, or an aggravation of an old one, is introduced by the demand that, as far as possible, every mine must eliminate waste.

The cost of recovering coal that is hard to mine and that the operator is disposed to leave in the mine is different for mines even side by side. If the government requires the operator to win that coal, it ought to, as far as possible, protect him from loss. Whether the government fixes prices or not, there will be price-fixing in every zone, whether that price be high or low.

Competition will fix the price of coal of a certain quality within a certain radius, regardless of the fact that some within that radius have high cost of production and others low cost. Cost of production has in the past been largely equalized by the high cost operator mining "easy" coal and leaving hard-to-win coal to be lost. If the government demands the recovery of that hard-to-win coal, one of two results will follow:

(a) All the coal mined in a zone will be sold at such high price that the coal mined in the high-cost mine will be sold at a sufficient profit. This will give the low-cost mine an excessive profit and compel the public to pay much more for their coal than is right.

(b) All the coal mined in the zone will be sold at such low price that only the low-cost coal will make a profit.

The result will be that all the high-cost mines will be forced to close. No business can be carried on long at a loss, or even no profit. The public does not want the mines to close in such number as to cause a shortage.

They would rather pay a higher price for their coal than to freeze.

When the Fuel Administration fixed the selling price of coal so low that the thin vein mines in a single congressional district in Pennsylvania, to the number of sixty-seven, were forced to close, the people demanded that prices be advanced so that they could get coal. Beside, this would defeat the attempt to conserve the coal supply. If mines are closed for long, they will be damaged, probably ruined, and all the coal lost. If they are reopened it will involve all the expense of opening a new mine.

The government, then, appears to have undertaken to do two apparently irreconcilable things: First,—require all the coal which can be recovered to be mined; second,—limit the selling price so that all the great body of the mines shall make a reasonable but not excessive profit.

The standard for fixing price is cost plus reasonable profit in the low-cost or moderately low-cost mines. It will be found that this class will include a large body of the mines. This class, while they may fret somewhat at the thought of any restraint, will very soon congratulate themselves that they are now selling in a stabilized market in which they have the novel experience of a fair profit.

Government Help To The High-Cost Mines

The operator must not lose the high-cost coal, but he cannot recover to a large extent at a loss.

One of the items that inspectors are required to report is: "How much more will it cost to mine the hard-to-win coal than it does to mine the other coal in *that mine?*"

This difference the government is fairly bound to see covered in some way. It does not follow that the owner shall make as large profit on his entire output as does the owner who has a low-cost mine. His mine is not so valuable. The government ~~does~~ not undertake to make all mines equally valuable. For instance, one owner has a vein of six feet, two of which he had been leaving at the top for reasons of poor roof, which it would be expensive

to prop if all the coal is taken. His competitor has a six-foot vein with a good roof, so that all the vein was mined at one time.

The first owner before was operating a four-foot vein in competition with a six-foot vein, and making a profit. His profit per ton was not as great as his competitor's profit. Now, if at the demand of the government and its help, he could market his entire six-feet at the same profit per ton as he did his four-feet vein, his total profit will be greater than before. That seems more than he ought to demand. If he now can mine his entire vein so as to make the same profit as before on four-sixths of his output and a smaller profit on the other two-sixths, he is justly treated.

Objection to a Subsidy

A great majority of the people protest against paying any bonus directly to anybody.

We want any bonus we pay to be deftly concealed in a tariff. In the first place, this is not in a true sense a bonus either concealed or open. It is, in fact, not paying a bonus to anyone. It is simply paying the operator part of his cost in redeeming our own coal, coal that belongs to the people and our posterity, coal that, to the full extent of its value, lengthens our industrial and commercial life, or supremacy.

In the second place, if this coal is recovered, it is much cheaper to pay the small amount of the help than to fix the selling price of all the coal in the zone so high that the high-cost coal can be sold at any profit.

How Will the Money Be Raised for the Help?

If this saving of waste is in the interest of all the people, they could be fairly charged with payment for it.

The Federal government represents the people, but it can only pay what it has, somehow, collected. The government does not collect a special fund for each item of expenditure, but it seems fair to collect this special fund from the industry itself.

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(a) Collect from the companies in each zone a tax on each ton of coal sold. The fact that coal is sold through central agencies will make it easy.

(b) Grant the coal companies an increase in selling price to cover that tax. The amount of that tax when spread over the entire tonnage will be small per ton. It will finally be passed on to the public in whose interest it is finally invested.

6. Partly cure the seasonal character of the coal industry. There is no feature of the coal industry that has provoked such fruitless discussion and that is so much lamented as that coal production seems hopelessly seasonal.

For several months in the year a large part of the mines are practically idle, and for other months can scarcely supply the demand. The average condition of the coal business is fairly reflected in a statement made to the late coal commission concerning the coal business in Montana:

Normal business in Montana means comparatively steady working time for three months, three-quarters time for three months, half time three months and quarter time three months.

These conditions bring about the following evil results:

(1) On the average, excessive, probably ruinous, cost of production. This fact is illustrated clearly by the experience of operators in this same Montana field.

The selling price of coal for Montana, fixed by the Fuel Administration, was fairly adequate during the year 1918 because of abnormal conditions, resulting in steady working time and creating a demand for all grades of coal. During the year 1919 practically every operator in the state has operated at a loss, even though the price restriction was removed and selling prices advanced thirty to fifty-five cents a ton for lump coal.

This loss was caused by the fact that in 1919 demand fell off, and mines operated only a few days each week.

We may illustrate the seasonal effect on profit by a not improbable case:

A mine has a capacity output of one thousand tons daily. The output can all be sold at the mine at \$2.50 a ton. The fixed charges per day, including interest, depre-

ciation, insurance, salaries, pumping, and clearing out falls in the mine are \$1000 a day. The fixed charges and added operating charges when the mine is running are \$2000 a day. If the mine is operated six days in the week, the output of six thousand tons is sold for \$15,000, cost of production is \$12,000, and the profit for the week is \$3000.

If the mine is operated three days in the week, the output of three thousand tons is sold for \$7500 the cost of production is \$6000 for the three operating days, and \$3000 for the three idle days, or a total cost of \$9000. The loss for the week is therefore \$1500.

(2) Injustice to mine labor. Miners' leaders, when demanding increased wages for mine labor, are confronted with mine payrolls showing large monthly earnings of the men.

They reply that the mining industry is seasonal; that, though many men make good wages when they can work every day in the month, yet, owing to the large amount of enforced idle time in the year, especially in summer, their yearly earnings are small.

The two factors that fix the yearly tonnage mined by the average miner during the year are: (1) the amount of coal demanded by the market during the year; (2) the number of miners.

Unless one or the other of these factors is varied there will, of course, be no change in the yearly output by the average miner. Whether that fixed amount of coal is mined in about one hundred and ninety-five days or thirty-two and one-half weeks, as at present, or in fifty-two weeks, makes no difference in the actual tonnage mined by each man in the year. The demand of a thirty-hour week, which was recently made, could only be rationally made on the assumption that the seasonal character of the coal industry is entirely eliminated. If the public could be persuaded or forced to buy as much coal in June and July as in January and December, and so for all the other months, spread the output of coal uniformly over the fifty-two weeks, then the same number of miners might

mine, by working thirty hours a week for fifty-two weeks, the demanded output that they now mine by working forty-eight hours a week for thirty-two and one-half weeks.

If the seasonal character of the coal industry could be changed so that men might have steady work if it did not increase the average output per man, even if pay per ton were not changed, it would benefit the miner. It would increase his physical and mental worth. If a man works only, on the average, a day and a half each week; some weeks no work; some, three or four days a week for three months, he is in danger of suffering physically, mentally, and perhaps morally. When the peak of the demand comes, his enforced idleness has rendered him unfit for the strenuous work he then has to do.

But when the time comes that the miners get their demand for a thirty-hour week, they will again couple with it a demand for a sixty per cent increase in mining rates. That is, they demand as much money for a thirty-hour week as they before received for a forty-eight hour week. If all these demands are granted, they are in danger of inviting a condition on which they have not counted.

First, if the seasonal character of the coal business is not changed, the number of miners will have to be increased. At the peak of the demand in winter it takes all the miners that are now employed, working forty-eight hours in the week, to mine the needed coal, and often there is a shortage of labor. It would take sixty per cent more men to meet the demand, if they worked only thirty hours a week than it did to meet the same demand when they worked forty-eight hours a week. Mining would be attractive, large pay and short hours, so the additional men could be readily obtained. Once in the ranks of the miners, the men claim the same right to continuous employment as the other miners. Thus this constant amount of yearly demand is now distributed over a larger number of men, and the average miner has less tonnage than before he got his sixty per cent increase. The increase in men will just balance the increase in price per ton and the miner will

not be benefited but the public will be the grievous sufferer.

Second. The alternative condition that they invite is that, if the seasonal character of the business is changed so that there is no appreciable peak of demand and the present number of miners could supply the demand by working thirty hours a week, that other labor will either receive a thirty-hour week or demand that the number of miners be reduced, so that they, too, will have to work thirty-five or forty-two, or forty-eight hours a week.

Increase in Yearly Demand for Coal Will Not Help Labor

As long as the present seasonal character of the coal business continues, increase in the amount of coal required by the market in a year will not increase the tonnage output by each miner. The number of men required at the time of year when demand is greatest will be increased in the same proportion as the increase in demand.

It is a real hardship that men who are called in to help in time of urgent need, and will be called again when urgent need arises, are cut off from a chance to earn living-wages when that need passes and demand dwindles to a minimum.

(3) Seasonal coal promotes car shortage. In summer-time coal cars that ought to be hauling storage coal are idle; there is little demand for coal.

In fall, when coal cars are in demand to put in some of winter's supply, engines are busy hauling wheat, corn, live stock, and other food supplies.

When winter comes in earnest, with little storage coal in the public's bins, when engines themselves use up large coal supply for their increased duty, when industrial and domestic demands are at their height, when snow-drifts and storms are at their cruel climax, the adequate car supply is at its lowest.

How can the coal industry be made an all-year industry?

The coal industry cannot be so changed that absolutely

the same amount of coal will be mined each month in the year,—it is not desirable that such result be completely attained.

It is certain that such change as is desirable may be attained by use of two means:

First. Voluntary co-operation of consumers. Propaganda shall make a placard, "Buy coal in summer," as much in evidence as, "Buy early for Christmas." This should be followed by statement of a very forcible reason for such buying, "Buy coal in summer and save money." The way in which they save money will be given later.

Second. Pressure on certain buyers even to point of coercion.

Railroads required to store three months' supply by November first. Railroads, being under Federal regulation, though now returned to their owners, may be required by the first of November gradually to accumulate in storage during the summer months a winter's supply for three months.

During the next five months,—that is, from November first to April first,—they gradually reduce their supply, so that by April first their supply is reduced to one month's needs. In order to accomplish this result in the five months, they buy and take out of the general market only three months' supply for themselves.

This plan accomplishes three very important results:

(1) The railroads buy during the summer months two months' supply more than they ordinarily do.

(2) They buy two months' supply less in the winter than they ordinarily do and thus reduce by that much the required winter output.

(3) Release the cars that now are needed to haul that two months' coal supply in winter, for use to haul other coal and freight.

(b) Certain other corporations must observe the same rule. I have suggested that certain steel companies be allowed cross-haul from West Virginia coal that otherwise would be reserved as "Navy" coal. Also it is proposed

to assist certain companies that will build byproduct plants, by granting them a loan. These and similar corporations should be required to store winter coal in the same way that railroads store their supply.

(c) State and municipal institutions, public utilities, street railways, interurban railroads, electric light and heat companies, water companies, schools, hospitals, State and county institutions, should be urged and, as far as practicable, required to observe such storage regulations as those before outlined. No hard-and-fast rule can be applied to every such consumer,—lack of storage-room may restrict the amount of storage. But even a partial conformity will be worth while.

It seems probable that, railroads, preferred industries, and public institutions, together with domestic and private users who can be induced to store in summer, will make one-half of the consumers in the quantity of coal used. If these store in the summer eight weeks' winter requirements more than their summer demands, that will add forty million tons to the summer output, and take that much out of the winter output.

During the five months, or twenty-one weeks, of November, December, January, February, and March the average weekly requirement is at present thirteen million tons, or a total of two hundred and seventy-three million tons. During the three months of April, September, and October the average weekly requirement is ten million tons, or a total of one hundred and thirty million tons. During the summer months of May, June, July and August the average weekly requirement now is about half as much as in winter, or six million, five hundred thousand tons, or a total for eighteen weeks of one hundred and seventeen million tons.

Now, taking forty million tons from the ordinary requirement of two hundred and seventy-three million in the winter, leaves two hundred and thirty-three million to be put out in twenty-one weeks, or say, eleven million tons a week.

The weekly requirement for April, September, and October remains ten millions.

Adding forty million tons to the ordinary output in the four summer months, makes one hundred and fifty-seven million tons output in eighteen weeks,—or say, eight million, seven hundred thousand tons each week.

If the same number of men work as now, in the five winter months they must work eleven-tenths of thirty hours, or thirty-three hours each week. In the months of April, September, and October they must work ten-tenths of the basic time, or thirty hours. In the summer months of May, June, July, and August they must work, say nine-tenths of thirty hours, or twenty-seven hours a week.

The conclusions are based on the assumption that the miners will work a definite number of hours each week. Of course, that cannot be fully realized. Car shortage, fluctuating demand, storms, snows, floods, and holidays make an absolute constancy impossible. But these results represent the fair average conditions.

The requirement of thirty-three hours a week in winter and thirty hours in April, September, and October may be met by five days of seven hours each week on the average.

The requirement of twenty-seven hours a week in the summer may be met by four days of seven hours. This requirement of four days of seven hours in the summer is a vast improvement on the present experience of fifteen or sixteen hours a week. It is not only an improvement but it may be ideal. It is the vacation time for mine workers,—a vacation while still earning.

Progressive companies are building their company houses so that each family can have a garden,—or a tract of land is set aside so that each family can cultivate a part. If the industry is made more stable, if the men become more contented they will more and more buy their own homes and have their own garden and chickens. This vacation time, on the average of two days in the week, gives the miners time and incentive to cultivate their

gardens and thus reduce the actual outlay of their money for vegetables. Also, these four months are the time in the year when farm labor is most in demand. The days spent in a corn-field or harvest-field bring many a dollar to add to the yearly income.

As was before said, the curing the seasonal character of coal mining will not give each worker a greater yearly wage unless demand is increased, or the number of men is decreased. Demand does not promise to be much greater in the near future. If the miner is not satisfied with his yearly wage, supplemented as above outlined, he ought to seek some other employment. If the seasonal character of mining is cured, eighty per cent of the present men can do the work that is needed. Thus, if the number of men is eighty per cent of the present workers, they would only have to work forty-two hours a week in winter; thirty-eight hours in April, September, and October, and thirty-five hours in May, June, July, and August. These numbers of hours do not seem excessive.

Cheaper Freight Rates in Summer

In order to make an incentive to consumers to store coal in summer, it has been proposed that railroad freight rate be thirty cents a ton less in summer than in winter. Operators also might make a small reduction in coal price, or rather the price fixed for them may be less by a small amount per ton in summer than in winter. It does, in fact, not cost the operator less in summer but rather more; however, the more he can increase his summer output the more it helps to reduce his loss. He ought to have a larger profit in winter to compensate for the small profit or loss during the time of small output in summer.

7. Reduce Our Export Of Coal To The Lowest Possible Limit

The only coal that we can export is our very best coal. For a short time, a considerable export will be necessary because of the need in Europe. We must help to supply what is needed to prevent suffering. For a time we will

export coal to Canada. That is where our largest export has gone in the past. Our export to Canada will gradually become a matter of exchange. Our coal will go to a contiguous coalless region of Canada, and Canadian coal will come to a contiguous coalless region of the United States.

The pressing present need for our coal in Europe is to a degree a temporary need. Every European nation will grow increasingly independent of us. Germany can more than supply its own needs, even while giving to France what she owes for destroying France's mines. France, her northern mines restored, with the added supply from Lorraine, can more nearly meet her own requirements than she could before the war. England, in addition to furnishing coal for her own use, will again supply Italy, France, Spain, and South America. The great coal fields of Russia, which were commencing to produce large output before the war, have great undeveloped areas. The "white coal" of Italy, Spain, and other countries is coming more and more into prominence. Our export to Europe before the war was almost negligible.

I know it is rank heresy to advocate a restriction of the export of our coal. A large export is the panacea for all our coal ills. One distinguished enthusiast predicts an annual export of a hundred million tons, and glories in the prospect. However, aside from present humanitarian ones, every argument for a large export of coal is fallacious:

(1) We have large overproduction of coal, therefore we must have large export to absorb it. This statement ought to be put the other way round. We must not and will not have overproduction, therefore we must not and cannot export coal.

(2) We can sell coal for export at a better price than we can sell it at home. It is small wonder that our export coal sells at a higher price than most of our coal sold at home. The coal we export is the very best we have, "more valuable than our anthracite, its exhaustion will be a calamity." The operator who thinks he is selling his coal at its full value is mistaken. If he continues to mine coal

for a few years, and looks back upon what he is now doing, he will see it in its true light. He sent his best raw coal across the ocean, giving enormous profit to the foreign ships that carried it, and saw the drugs, dyes, and medicines that were made from poorer coal sent back to us by the millions of dollars worth. It is a strange craze to sell raw coal and import its valuable and costly constituents, and then condemn the policy of exporting our wool and bringing back the expensive fabrics we ought to make at home.

As a nation we have interest in the preservation and developments of our natural resources.

We are interested in export of coal and its restriction from its economic aspect. But we are vitally interested to stop export of our only "Navy" coal. Most of the coal now being sent abroad is from our semi-bituminous coal. To export, or use,—for any other than government use,—our Pocahontas coal is what would be treason if done consciously with intent to do what it in fact will do, *weaken our national defense*, by making our future navy a second-class navy.

CHAPTER XII

METHODS OF ENFORCING THESE CONTROLS

By Amicable Co-operation of States, Operators, Railroads and the Public—By Pressure Upon Certain Classes That Refuse—Railroads Must Not Extend Line or Put in Switch Without Certificate—Railroads Must Embargo Outside of Fixed Zones—Price-Fixing Agreed Upon in Compensation for Selling and Distributing Agencies—Objections to Maximum Price-Fixing By Operators—Objections to Minimum Price By Consumers.

1. By amicable co-operation of States, operators, railroads, and the public. New ways of doing things take time, tact, and patience for their introduction. Some of these forms of control have been suggested now and again as something about which we may dream but for which we may not hope. Some will meet with denunciation, but in time this control will be accepted with enthusiasm.

2. By pressure exerted upon those who refuse to co-operate. Much of the machinery for enforcing them is already constructed. Congress is clothed with ample power to enact any additional legislation that may be needed.

Conserving the coal supply is providing for the general welfare of the United States, "it is providing for the national defense." Let us examine these controls to see what present laws might warrant.

(a) *No New Mine to Be Opened Without Certificate*

This may be enforced, if necessary, by Federal control of railroad extensions. No new mine can do much to inflate the commercial coal supply, without railroad connection. The new railroad bill has the following restrictions on new railroad connections:

No carrier by railroad, subject to this act, shall undertake the extension of its line of railroad, or the construction of a new line of railroad or shall acquire or operate any line of railroad or extension thereof or shall engage in transportation under this act, over or by means of such addition or extended line of railroad unless and until there shall first have been obtained a certificate from the commission that the present and future public convenience and necessity requires or will require the construction and operation of such additional or extended line of railroad or the operation thereof.

This seems to inhibit the construction of a spur or switch, or the operation of any such construction that the coal company may make without a certificate.

(b) Requiring a Certificate Before a Mine Can Be Abandoned

A railroad cannot now abandon any part of its line without a certificate.

No railroad shall abandon all or any part of its line of railroad or operation thereof unless and until there shall first have been obtained from the commission a certificate that the present and future convenience and necessity of the public may permit such abandonment.

A railroad cannot of its own motion destroy a mine or other industry by abandoning a spur or switch which now serves it. The government protects the mine, the mine is bound to reciprocally observe the government restriction on its own abandonment. If a mining company wants to abandon a mine, it is because conditions are such that it cannot be operated at a profit, or that it is worked out. If the Federal commission refuses a certificate, it must be because the mine has recoverable coal that is not yet mined. It is not likely that the operator will want to abandon his mine when shown the new way in which it is proposed to help him win all the coal. A mineowner who would attempt to evade

this requirement would never be granted a permit to open a new mine.

(c) *Requiring the Zoning of the Mining Fields*

Embargo by railroads can be enforced, if necessary. Railroads have always claimed and exercised the right to embargo freight for cause, and sometimes without sufficient cause. Railroads may now be required to confine their coal freight within the zone in which it originates and embargo all coal from that zone with reference to any terminus outside its limits. Railroads and coal men will soon find that the advantages of such zoning far outweigh its disadvantages. The railroads will not have their cars scattered over every other railroad, used by it till it sees fit to return them. Operators will have a better car supply and better profits. Only a certain price can be passed on to the consumer, the less of that which must be charged against freight the more there is left for operator and labor.

(d) *Allow and Encourage Selling Agencies*

(1) Congress which enacted the Sherman Anti-Trust Law, a law that aimed to correct certain abuses and that, while it did much good in the past, has been so construed as to work much harm,—may modify it by providing for such agencies and repealing all laws inconsistent therewith.

(2) The Supreme Court has practically construed out of the Sherman Law any power to prevent reasonable selling agencies. In the Northern Securities case they held that it must be construed “according to the rule of reason.” Strange that a court decision should be necessary to introduce common sense in construing a law.

In the United States Steel case the court held that restraint of trade, or seeming monopoly, must be shown

"to be injurious to the public interest" before it will be crushed.

Under these decisions selling agencies ought to be safe. Applying the "rule of reason," selling agencies are not "injurious to the public interest" but greatly promotive of the public interest.

They promote conservation in mining, by limiting ruinous competition that tends to wasteful methods of operating; they encourage better preparation of the coal, by docking poorly prepared coal; they promote more uniform operation of mines and thus help both operators and labor; they ensure better prices to the consumer, by reducing selling cost; they reduce freight charges by sending coal from the mine nearest to the buyer; they give better service to the buyer, for now coal is distributed scientifically and not helter-skelter, since the entire field is mapped out and its wants studied.

(c) *Fixing Maximum and Minimum Selling Price*

(1) Many operators may object to a selling price in the light of their experience with the Fuel Administration; their mines may have been closed, or they may have suffered loss because of the low price fixed for their selling price. Any such price-fixing, which either caused loss or did not, on the contrary, allow a profit, was in direct violation of the very law under which the Fuel Administration was acting. The Lever Law required that prices be fixed so as to cover cost of production, depreciation, depletion, and a fair profit. Toward this result the Fuel Administration constantly strove. As data were collected and wrongs righted, operators became more and more reconciled, and deep down in their hearts they felt that if the Lever Law were executed in its real spirit they would have had the time of their life.

(2) Consumers may object to a *minimum* selling price. They can see that Federal fixing of a maximum price is

intended for their protection. Yet some of them had an object lesson on the fact that prices may be fixed too low when they saw the mines on which they depended for coal being closed because they could only operate at a loss and sell at the low price fixed for their coal.

A too low selling price may be more damaging to the public than a too high selling price. Thus, if a strong company sells temporarily at a price less than cost of production, it may have either of two effects: first, it may freeze out all weak competitors and when they are out of the market the strong company raises prices abnormally; second, the competing companies may meet the low prices by mining "easy" coal, and thus defeat the effort at conservation of the consumers' future supply of coal.

(3) Political economists may object. They say "relative supply and demand must fix prices." It is strange that this dictum of the political economists should go unchallenged when used in the sense in which they use it. In a commodity, such as coal, *scarcity* is not necessarily an excuse for high price. We are speaking now of what ought to control prices. Cost of production, depreciation, depletion, and a fair profit constitute the only true moral and just basis for selling price. When Joseph and Pharaoh, acting wisely on inside information, gathered every year a portion of the people's corn and stored it against the lean years of famine, they were entitled to plenty of cornmeal and a good salary. But when they in times of scarcity sold the people their own corn, held in trust for them,—first for all their money then their land, then for themselves,—Joseph and Pharaoh were the greatest profiteers in all history. Radium is scarce and dear, but not properly dear because it is scarce. Near a town in Western Pennsylvania is a plant devoted to the production of radium. A neighbor expressed the real basis for its dearness when he said, "That is the

strangest factory I ever saw: tons and tons of material brought here in trains and taken to the mill, and nothing coming out." These tons of material were hewed out from almost inaccessible regions in the Far West, hauled thousands of miles, and the output of all this labor and cost is carried out in a little tube. If we count cost of radium in money spent, labor of brawn and brain, it *ought* to be dear,—but not simply because it is scarce.

Scarcity of coal and a small output establish a legitimate basis for greater selling price than if the output is large, but not because it is scarce primarily but because it costs more to produce it. Overhead charges, depreciation, and fixed charges are greater per ton when spread over a small output than over a large output.

(f) *Maximum Price Fixing is Taken in Exchange for the Right to Establish Selling Agencies*

The objection to selling agencies has been that the power to charge exorbitant prices is thereby put into the hands of operators. This objection is removed if prices are fixed by other than the combining operators.

It ought to be repeated, however, that prices should be liberal enough to give a profit commensurate with the great risk and increasing difficulties in mining. Consumers have been used to such low prices that they are apt to think such conditions will last forever. But when they are fully informed, they will be willing to bear the addition of a cent or two a bushel, knowing that the price is fixed by a just and competent commission.

CHAPTER XIII

LABOR AND WAGES

Causes of Unrest All End in Demand for More Wages—Does Labor Give Coal All Its Value—Coal Land and Equipment Crystallized Labor—Large Outlay Favorable to Labor—Standard of Mine Wages—Methods of Settling Labor Conditions and Wages—"Mining Board of Labor Adjustment" Fix Conditions Not Wages—"Mining Labor Board" Adjust Wages—Public Is Made Arbiter After Being Fully Informed—Collective Bargaining—Bargaining By Union Officials and Operators—Good if Union Is Incorporated, Becomes Legally Responsible, and Can Enforce Its Contract—At Present of Little Binding Force—Ideal Collective Bargaining.

One of the most difficult subjects connected with coal mining is the adjustment of wages and other labor conditions.

Many of the conditions affecting the welfare of mine labor are regulated by law, such as ventilation, use of lamps in gaseous mines, permissible explosives, and manway for escapes in case of accident. General laws fixing mine wages have not yet been passed, but laws requiring companies to pay shot firers, require them to pay for all the coal mined, including slack coal are in force.

The Constitution of Ohio gives the Legislature power to pass a law fixing minimum wages.

Miners have been in a continual state of unrest. Strikes large or small are always going on in some part of the field, and discontent and agitation for strike in many others. Labor agitators and politicians thrive on strikes and discontent, but operators and miners do not.

Every strike renders operators less able to pay good wages, and involves a direct loss to miners, and scarcely ever a compensating indirect benefit. Direct and in-

direct loss to the public has been great beyond computation.

The public is generally very sympathetic with labor. But when it sees labor careless of public comfort and interest, it changes sympathy to resentment. It is hard to keep a warm heart in a freezing body.

The causes of this unrest are as varied as the character and conditions of the men. Foreigners are not getting what they expected from the glowing accounts they got at home; young men with no home ties, no interest in the company, in each other, or in the community, want amusement; men who do not read don't know what to do with their idle time. This is the soil from which grow strikes. The union official, the walking delegate, the everlasting agitator,—these can weave all these causes into one proposition: "What you want is more wages."

Whatever the real end that the officials have in mind, the ostensible end put forward is more wages. An appeal for more wages is one in which all can join.

In a company composed of the radical, the gullible, the ignorant, the intelligent, and the fair minded, it is not much wonder that there is a great difference of opinion as to how much more wages they must receive.

They may start together by quoting the selling price of a ton of coal and the wage paid to the miner for digging it. If the selling price is \$3 and the mining price is \$1.10, what has become of the difference, and what should be done with it? The most pronounced radical says it should be divided between the miner and the other labor employed in producing it. If he is told that it must cover various things beside labor, such as supplies and a proper return for capital invested, he replies: "There is no such thing as capital upon which a return is due. Labor gives coal all the value it has."

This dictum might be accepted as a not bad standard of value. But the value which any object has to

the man who claims to own it does not necessarily come from his own labor upon that particular object.

Labor as a thing of value can be exchanged for other labor. We make that exchange convenient by means of some medium,—such as money. The miner when he is working may truly say: “I am just coining money.” When he exchanges that money for a house, the house is his crystallized labor. He has exchanged his mine labor for the labor of the carpenter and mason. If such a man gets that far along, he may be able to see that the coal land, the tipple, engines, cars, shafts, rails, boilers, fans, mules, and motors are just as much labor as the shoes on his feet and his home. Hundreds of people have bought bonds and stock of the company to furnish the money to buy these equipments, who worked for the money, or their fathers and mothers did. Every tube in the boilers, every nail in the tipple, was worked for by someone.

If these equipments are labor, they ought to bring some return for their use and destruction; every day destroys a part of this accumulated labor that was worked for by someone, until finally it has all been destroyed.

It is no more fair to take this labor without pay than it would have been to take the labor for which it was exchanged without pay, or to take the miners’ labor without pay.

There is a class of “reformers” who contend that it is wrong to pay any interest or dividend even if capital is accumulated labor; they say that it is enough that it be kept intact and returned to the owner. If this were true it would not affect the present case.

Interest and dividends paid on stock and bonds (when paid at all as a majority of the coal companies are never able to pay any dividends) in the mining industry are simply paying back the principal in installments. The equipment for which the principal was paid is soon worn out and new equipment has to be

bought. When the coal is exhausted there is nothing left to return to anybody.

Mining is different from other industries in that every year the principal grows less and finally entirely disappears.

A large coal holding by the company is favorable to the miner. This is a very large item which must be charged to cost and one which is very little considered in wage and cost discussion.

If labor is to be stabilized, labor and capital harmonized, so that the industrious thrifty worker may settle down in one place to spend his life there, own his home, identify himself with the community, and take his proper part in civic affairs and accumulate a competency, the company must spend a large amount of money for coal lands and equipment. It must have enough coal land to last for forty, fifty, or a hundred years. This land may cost from \$300 to \$3000 an acre, and from fifteen thousand to twenty-five thousand acres must be bought as well as a considerable surface area. Properly to develop such land only the best equipment that money will buy will be installed. Concrete shaft-lining, haulage-ways are made; cars, tipples, engines, and all the varied equipment must be of the most modern. The cost of carrying this expense, renewals, new devices, taxes, selling costs, workmen's compensation,—all must be included in the cost of the coal.

To this must be added a reasonable profit and the cost of labor. And the minimum selling price should be fixed by the government so as to cover all these.

Standard Of Wages For Mine Labor

It is a trite saying that "labor should have a good living wage." The public should be willing to pay such a wage. They pay now for their coal not more than one-fourth to one-fifth as much as they do in coal-exporting England.

Each principal industry receives a larger return on its investment than the coal industry does, largely because it buys its coal so cheap. The miner is doing a public service and earning his living in a grimy, hazardous work.

If we could agree as to what is a fair annual income for mine laborer, including the necessities and comforts of life and a proper saving for the future, and knew the number of days the days-man will probably have an opportunity to work, of course his proper day's wage is fixed. Also, if we could know how many tons of coal a pick-miner can dig in a year, his proper price per ton is at once fixed, so that he can earn the standard yearly income.

It seems fair to say that it ought to be possible for a skilled man to earn \$1500 a year. Many large incomes have been made by miners in the past even before the new increase.

Miners in the non-union mines of West Virginia have had an income of \$3100 a year; with the added twenty-seven per cent, their earnings would be nearly four thousand dollars. These large incomes are rather exceptional and in circumstances not open to all.

Probably a better average would be \$1200 to \$1600 a year. With the added twenty-seven per cent, the amount would be \$1500 to \$2000 a year.

The Commission appointed by the President fixed the price for pick-mining in parts of Pennsylvania and Ohio at \$1.11 a ton, and day labor at about \$6 a day.

To earn \$1500 the pick-miner will have to mine thirteen hundred and fifty tons in a year, which is six tons a day for two hundred and twenty-five days, and the days-man must work two hundred and fifty days

to earn \$1500 or two hundred and twenty-five days to earn \$1350.

Method of Settling Labor Disputes

The new railroad law in the last analysis makes the public the umpire. Neither operators nor miners can dare for long to defy public opinion, when the public is both interested and understands the issue. Heretofore there has been no effort to inform the public as to the merits of any labor difficulty. What the people learned about any dispute was from the sensational misinformation found in yellow journals and speeches of misinformed office-seekers. Adapting the provisions of the railroad act to the mining industry by proper substitutions and eliminations, we have the promise of a suggestive study for a wise solution.

(1) The Federal Mining Commission authorizes the formation of a "Mining Board of Labor Adjustment."

A Mining Board of Labor Adjustment may be established by agreement between any operator, group of operators, or the operators as a whole, and any employees, or organization, or group of organizations thereof. Each such adjustment board shall (1) upon application of any operator or organization of employees, whose members are directly interested in the dispute; (2) upon written petition, signed by a given number of unorganized employees directly interested in the dispute; (3) upon the board's own motion, receive for hearing and as soon as practicable and with due diligence decide any disputes involving only *grievances, rules, and working conditions*. This board does not consider either wages or hours of work.

(2) The Mining Commission creates a "*Mining Labor Board*." This board shall consist of nine members appointed by the President by and with consent of the Senate: (1) three members constituting the labor group, chosen by the President from not less than six nom-

inees made by the employees; (2) three members constituting the management group, chosen by the President from not less than six nominees made by the operators; (3) three members constituting the public group, representing the public. The Labor Board, (1) upon the application of the officers of organized labor, whose members are directly interested in the dispute; (2) upon application of a certain member of unorganized employees directly interested in the dispute; (3) upon its own motion, shall receive for hearing and with all due diligence decide all disputes with respect to wages of employees. All decisions of the Labor Board with respect to wages shall take into consideration: (1) the scale of wages paid for similar kinds of work in other industries; (2) the relation between wages and cost of living; (3) the hazard of the employment; (4) training and skill required; (5) character and regularity of employment; (6) any inequalities in any former adjustment. They shall gather, compile, classify, digest, and publish data and information, to the end that the Labor Board may be equipped to perform its duties and the Public may be properly informed.

The Public the Umpire

These boards do not set out any specific way in which their decisions shall be enforced.

The Labor Board, in case that any decision is violated by any operator, employee or organization, after due notice and a hearing to all persons directly interested in said violation, shall determine whether such violation has occurred, and make public its decision in such manner as it may determine.

This is simply, so far, a reliance on public opinion for enforcement of the board's decision. In the opinion of many, an anti-strike provision ought to have

been kept in the railroad law. But Congress weakened. They were afraid to deny the "inviolable right to strike."

Collective Bargaining

Bargaining between the operators and the United Mine Workers.

Collective bargaining has but one meaning in the minds of the officials of the United Mine Workers. It means bargaining between the United Miners' Union and operators. It means that at a certain time a convention is held at which delegates representing the different local unions in the district meet with representatives of the operators in that district. The convention organizes, then the miners in separate caucus formulate their demands for an increase in wages above their former contract, and other conditions favorable to the miners. These demands are presented to the operators, who also hold a caucus, and decide what they can do. Of course, the miners' demands are not accepted. It is not expected that they would or could be, for that matter. The debate is carried on in open convention,—probably for many days. Proposals and counter-proposals may be made, until finally an agreement is reached, or it is found impossible to agree.

If no agreement is reached before the end of the contract period, there is a strike.

If they agree finally on terms, wages, length of time the contract is to run, and other conditions, the operators and officials of the union sign a contract, which is supposed to bind both parties and every member of the union.

If the new contract is fair to labor, and is such that operators can mine and make a reasonable profit, so far it is good. The debate and negotiations in convention ought to show both parties what is fair.

It ought to be done more intelligently than it could be with less intelligent and poorly informed individual

miners. The operators ought now to be able to decide what they can afford to sell for and what labor will cost them. But, unfortunately, this is not true. A contract presupposes equal responsibility on the part of both parties. If the owner of a mine does not pay for labor, a lien is entered against his property, which comes ahead of almost every other claim. If the miner violates his contract, made for him by his officers, the union and officials can in no wise be held responsible. The United Mine Workers will not incorporate so as to make the union have legal responsibility. They are exempt from the operation of the anti-trust legislation. The miner's vote is more valuable to Congressmen than the votes of the operators,—there are more of them. They are just a group of men ostensibly binding themselves to do certain things, if it is convenient.

The operator cannot calculate costs, for he cannot tell at what time a strike will come that will add very much to the cost. He cannot tell whether he can fill his contract orders, for he cannot tell whether the miners will work or not. If The United Miners' Union will incorporate and become as much responsible as the operators are, and the individual locals and men can be made to keep their contract in good faith, collective bargaining between the union and operators is probably better for the kind of labor employed in mining.

That the miners' officials had become convinced that unauthorized strikes were a just cause of complaint on the part of both operators and the public, and were bringing the union into disrepute, is shown by the terms embodied in the wage agreement made in April, 1920.

Whereas stoppage of work in violation of the agreement has become so serious as to menace the success and perpetuity of the U. M. W. of A. and our joint relations, this conference instructs the respective district executive boards to meet the operators for the purpose of agreeing on a penalty clause for strikes and violation of agreements.

Then again,

The fulfillment of this agreement is guaranteed by the international union, and the fulfillment of joint agreements entered into in any district shall also be guaranteed by the officers of the international organization as well as by the officers of the district, and it shall be their duty to see that all such agreements are carried out in the letter and spirit.

, This agreement and guarantee was signed on Thursday; the next Tuesday's papers carried the headline:

7,000 DAY-MEN STRIKE AT ILLINOIS MINES.

So much for the value of the guarantee.

Ideal Collective Bargaining in a Single Company

Collective bargaining could be ideal in a company if operator and miners were determined to be fair, the operator only demanding a reasonable profit, the miners ready to work for their mutual benefit and accept such wages as the business can pay. Let us outline such a plan.

The operator and representatives of the miners meet to determine what wages can be paid and what other conditions in the mine are to be observed during a period,—for example, for one or two years. The operator goes over the various items of cost,—many of which, such as depletion, depreciation, workmen's compensation, and cost of idle time, had never entered the miner's head,—and explains what cost will be if the mine is operated all the possible time, and what it will be if operated other less number of days; that is, costs exclusive of labor.

The Miners' representatives present the case of labor with like estimate of cost of living, comparison with other labor, risk of the work, and an amount for saving account.

This sum added to the other items of cost will give the normal cost. Many unforeseen causes will, no doubt, increase that estimate.

The selling price of coal cannot be forecast with definiteness, unless the government has fixed prices.

A contract is made on a sliding scale of wages, based on this normal wage and normal cost.

(1) The operator is bound to do all he can to keep down all the costs in his itemized list, consistent with the full recovery and conservation of his coal.

(2) The miners bind themselves, legally, to co-operate in every possible way to reduce the cost of mining, economize the supplies, mine carefully, and refrain from strikes.

Preparatory to making out the payroll, the officers of the coal company and representatives of the miners canvass the costs and selling price.

If the remainder after deducting costs is enough to pay labor more than the scale, it is given to the laborers. It is better policy to give laborers part of the excess and pass the rest to their account. If the remainder is not enough to pay the full scale, wages are reduced in equal proportion to all. Any surplus to the credit of the miner may be used to bring his wages up to the scale.

On the average the men will make more money in the year than they would on a regular scale of wages.

Loss from strikes to both operator and men will be eliminated. Loss from sympathetic strikes will be saved. Union dues will be saved. The men will be freemen.

CHAPTER XIV

IS THE RIGHT TO STRIKE "INVIOABLE"? DOES MIGHT MAKE RIGHT?

A Vicious Half-Truth—An Individual Right to Quit Work—If He Has No Dependents—If He Has Dependents—If He Has Contracted to Work, Under What Conditions May He Void His Contract?—Group of Employees Who Have Contracted to Work—Strike Is a Conspiracy to Do Harm to Operators and the Public—Contract Made By Officials of Union Has Small Binding Force on Members of Union, Since They Did Not Individually Sign the Contract—Small Binding Force on Official As Long As They Are Not Legally Responsible.

"The inviolable right to strike" is the last word in the argument as it comes from the President and is echoed all down the line of speakers and writers. We are startled at the audacity of some farm organizations that are daring enough to raise a voice of protest. This right to strike has been set up as a test of liberty. Any one who has enjoyed that privilege has had just that much more liberty than he ever knew before.

Stated broadly: "the right to strike is inviolable" is a vicious half-truth, which has induced untold material damage and mental and bodily suffering. What wrongs have been done in the name of this liberty! This slogan had its spring in a very sacred human right,—the right of a freeman to his own labor. It came from our horror of slavery. Abraham Lincoln voiced that right in one of his famous speeches:

When I have seen strong arms plowing, sowing, reaping, threshing, grinding, baking, I have hoped and believed, that, in some way, in God's good time, the hand that feeds the mouth might own it.

The man who argues for inviolability hushes all opposition with the challenge, "Would you again make the

workingman a slave?" Let us look a little more closely at this inviolability claim as an universal truth.

(1) As applied to an individual laborer.

The individual quitter is not a striker in the proper sense, it takes more than one to conspire, but his rights are much like the rights of a group of individuals.

(a) As to refusing to work at all. If the maxim "he that does not work shall not eat" were strictly enforced, there would be little refusal to work. The man who begs on the street is arrested; if he wanders about with no attempt to earn a livelihood, he is arrested as a vagrant. If he has no dependent and keeps out of sight of the officers, he may escape work. If, however, he has dependents, if he has married a wife and brought children into the world, the court will have something to say when he pleads his inviolable right to loaf.

(b) If he engages to work and then quits at his own pleasure: In military service it is easy to say what will happen. If, as a soldier, he quits, he is a deserter. If he quits on the battlefield, he is shot. If he quits in the navy, it is mutiny. In civil service, the consequences are usually not so serious from quitting as in military service, and hence not so severely condemned. In civil work, whether he has a right to quit his contract work depends on circumstances. The presumption is that he does not have that right. The burden of proof to show that he has the right lies on him. If he has contracted to do work, he is as much bound to work as he would be bound to deliver any other merchandise which he has sold. His labor is his merchandise, he had a right to sell it. He did it freely. His contract to work is voidable, it is true, but only on the same grounds that any other contract may be voided. (1) If he is too ill to work, or he becomes physically unable to fulfill his contract without injury to himself, he is relieved of his obligation. An act of God abrogates any con-

tract. (2) If there was fraud on the part of his employer. Fraud vitiates any contract. (3) If he has hired for a long term of service, and circumstances which could not have been foreseen arise, which make it impossible to carry out his contract, such as very high cost of living, and no concession will be made by his employer, the time may come when the religious command "swear to your own hurt and change not" is not binding. This last is in essence the foundation upon which strikers base their defense.

(2) As applied to a group of organized or unorganized employees. This is the only sense in which the term strike is used. A strike is conspiracy, and hence could only apply to a group; not, of course, that every group of people combining to do a certain thing is a conspiracy in the accepted meaning of the term. A conspiracy is a combination to do an illegal or morally wrong thing. Every strike is without any doubt such a conspiracy.

(1) A conspiracy against the *operators*. It is a combination of a group of employees to do such harm to the employers that they will be forced to grant their demands. It takes the employer's property and destroys it. Often the destruction is patently and maliciously done. But even if no violence is committed, the strikers take from the employer interest on his investment during the strike, his overhead expenses, cost of keeping property in repair and restoring it to a working condition, and loss of legitimate profit. These losses can never be recovered. It is not so apparent as is destruction of machinery or tippie but it is as real as if the sums thus lost were converted into government bonds and burnt. But, it is objected "the employees do not create this loss, they simply quit work. It is the misfortune of the employer to have a plant that will not operate without labor. Or rather, it is the misfortune of the plant to be owned by a stubborn

or unjust operator." They do not "quit work" in the proper sense of the word. If they did, they would bundle up their effects and move to other fields or engage in other work. They do nothing of the kind. They attempt to hold their places open so that they can return to them when they get ready. They use every means possible to prevent others from filling their places. They would be the most disappointed people in the world if the mine is dismantled and they are forced to "quit working" in reality. No, a strike is just a holdup, a "stand and deliver." It says to the operator: "You must employ us to work for you; you must pay us our price whether you are able or not, and until you agree to do it we will do you such damage that you will be forced to yield."

(2) Every coal strike is a conspiracy against the public. Not that, in general, there is any malice in it toward the people; not that the strikers seek to extort money from the public. Most employees believe that coal barons have such vast profits that they can absorb all increase of cost and not pass it on to the consumer. As far as they think of consumers at all, they think of them as the revolver that they point at the head of the operator to compel him to pay the demand and resume operation. Notwithstanding the fact that a strike is not aimed at the public in malice, yet it is a conspiracy that always works damage to some part of the public, and often untold suffering and misery.

It would be a senseless official of a miners' union who would order a strike that would not produce inconvenience and damage to some consumer. If nobody needed coal, operators wouldn't want to operate, couldn't operate, and couldn't pay any wage, much less an increased wage. A time is chosen, if possible, when demand for coal is most urgent,—as in the middle of winter in 1919, when shortage of coal was pronounced a calamity.

A "conspiracy to accomplish a selfish purpose" is a harsh sentence. Use milder, softer words if possible, but they must mean the same thing. We want to use as soft words as we can for we are applying it to hard working, good citizens, just and honest in their private relations, and worthy of our respect. The mine workers' contract was made, as they insisted, in collective bargaining. It gives them solidarity, better terms in their contract, and greater strength in a strike, yet that very fact makes the contract sit more lightly upon them. A contract made and signed by their officers in a distant city, by men whom they never saw, to the breaking of which there is no penalty, sits lightly on the conscience. They say: "The men who signed the contract know the extent of its binding force and have a right to absolve us from its operation by a word." If every worker had signed for himself, it would seem more binding. The great majority of the miners would not violate a contract to which they have set their own hand and seal. And their officers would hesitate long if they were made legally responsible.

A so-called strike at the end of a contract season. It may be that a cessation of work at the end of a contract season can scarcely be called a strike.

Ordinarily, a month or more before the end of the contract season in a union field, operators and the officials of the miners' union begin to bargain for a new contract. If they have not agreed at the time of the end of the contract, in the anthracite field the men continue to work while bargaining is still carried on. That is the reasonable thing to do. They know that they will continue to work under some contract. They have committed their case to their union officials, and the award will no doubt be retroactive to the end of the contract season, and by continuing to work they will not lose the wages for idle time,

In the bituminous field, if no new contract has been made at the end of the old one, the men quit work. The anthracite men do more wisely; but there is no compulsion on the men. As long as there is no conspiracy to do harm, it is scarcely a strike. At first it is a kind of "stock taking." It is a time to invoice conditions, a time to weigh new cost of living, and measure it against former wages.

The workers are no more to be condemned than are operators who shut down to install new machinery. Any loss to the operators may reasonably be charged up as being incidental to the business of coal mining. Miners cannot be blamed if they insist with a good deal of energy that their places be left open to them. But when a reasonable time has elapsed, when not to operate is a loss not properly incident to mining, the operators have a right to say to their former employees:

"Let us reason together. If we cannot give what you can afford to take, then you must not hinder others from working for us who can accept what we are able to pay."

We say they ought to be able to say that much, and proceed to operate with other labor.

But they cannot do anything of the kind as matters are now. The United Miners' Union has a monopoly of nearly all mine labor in Western Pennsylvania, Ohio, Indiana, Illinois, Kansas, and Iowa. If the Miners' Union would give the operator the "privilege" of hiring other than union men, he would have to go outside of those States, at least for skilled miners. The two contentions on the part of the miners are: (1) we cannot quit mining and go into other lines of employment, since mining is our business, we have learned and know no other business; (2) since we must work in the mines our only weapon of defense is the right to strike.

This last is virtually a confession that striking is conspiracy to inflict damage; but a plea in justification: "The end justifies the means." To the plea that a miner has learned the business and knows no other, the operator may justly reply:

"You learned the business in my mine. I paid you, under the unions demands, the wages of a skilled worker when you were unskilled. I bore with many mistakes and your inexperience. We have given you exclusive claim on your place. We have paid you good wages while you are learning. Your union has monopolized the labor market. You owe us consideration."

Many individual miners accept that fact, but cannot act on it so long as the officials of the union do not declare the strike off. It goes on for months,—a year in Ohio, when the miners struck for the mine run weighing law. It goes on in Colorado in the midst of rebellion in attempt to unionize the mines, where the issue was not wages at all, but a consuming desire on the part of the union officials to have more members in the union, so that more fees could be collected to swell the balance in the union treasury. Such things ought not to be. Surely some way such as we have before outlined must be devised by which a just and intelligent court may settle these large strikes and prevent the thousands of petty annoying strikes for every imaginable and unimaginable excuse.

CHAPTER XV

INDUSTRIAL DEMOCRACY IN THE MINING INDUSTRY

Syndicalism in England—Syndicalism in the United States—Results of Syndicalism: Wastefulness, Coal Supply Absolutely in Hands of Miners, Unlimited Wages—Co-operative Coal Mining—Miners Own a Mine and Operate “Democratically”—Miners Lease a Mine and Operate “Democratically”—Example of Such Company in Indiana—Result Disappointing—Theoretical Advantages: Operator May Be Paid a Fair Compensation, Miner Gets All His Product Will Net Him, It Settles Labor Disputes—Weak Points: Inexperience of Miners in Management, Too Little Working Capital, Mine Wastefully, Mine Labor Is Too Restless and Can Bear Neither Plenty Nor Scarcity—A Company-Owned Mine, Managed Democratically—Colorado Fuel and Iron Company.

Democracy is the name to conjure with. President Wilson says, “Industry must be made democratic,” and all down the line it goes. One wonders what definite thing is meant. Very few mean anything definite. It ought to mean that industry in this democratic nation should be conducted in a way befitting a great, righteous, democratic people. It is safe to say that no man in the world has thought out to the end what it will mean to us if it be driven to the extreme demanded by the miners in Great Britain,—the extreme which is in the hope of a large element in the mining industry in this country. It means nationalization of the mines, then *syndicalism*.

First. Syndicalism in England

The Miners’ Federation in England demanded nationalization of the mines, and “while you wait,” a six-hour day and thirty per cent increase in wages. A royal commission, called the Sankey Commission, granted them a seven-hour day in 1920 and a six-hour day thereafter, a large increase in wages, and declared that:

Nationalism or some other system of national purchase and joint control must be substituted for the present system of ownership.

The miners demand immediate fulfillment of the award. "Mines for the nation!" was their slogan, and a taking one it is. Yet at a subsequent hearing by the commission they disclosed their real purpose. Nationalism is but a stepping-stone to syndicalism. Not mines for the nation but mines for the miners was the demand. They demanded that the nation acquire possession of the mines (it mattered little to them how) by issuing low-interest bonds for their purchase. Then they demand that the mines, without requiring any royalty, be given over to the "Mining Council" of which one-half was to be appointed by the Miners' Federation; that the mining council shall have no power to settle wages in the future, except in consultation with the Miners' Federation. The Miners' Federation still retains the right to strike.

We see here the amazing proposition that the nation pass over to a Soviet,—which is not responsible to any government and which knows probably nothing of the management of the coal business,—the industry that has made England great, industrially and commercially, and on which the life of the nation depends.

Second. Syndicalism in the United States

It may seem that syndicalism in Great Britain is purely an academic subject for us in the United States. Let us hope that it may continue to be such. The American miners demanded twice as large increase as did the British, and in addition to the six-hour day they demanded a five-days week, and from time-and-a-half to double-time for extra hours. They also commenced by demanding that no mine should work more than one shift in twenty-four hours. This strange demand would often work hardship on the operator, but usually

more hardship on the miners than on the operators. In a mine that has twice as many men as it has places for them to work, half of the men would be idle every other day. Each man would only work fifteen hours a week or an average of two and a half hours every week-day.

This demand was not finally pressed. It is well to reserve some things for another time. Neither was nationalization pressed. Officers of the Miners' Union denied that they were demanding it. No one knows better than union officers that nationalization and ultimate syndicalism is the coveted goal. The harder the terms of settlement at each new contract time,—the more miserable they make the life of the operator,—the nearer is that goal. The plea for syndicalism is one that appeals to the mine worker. Coal in the ground was placed there without any work of man. It has no value in the ground. All the value it has came to it from the labor put upon it,—therefore labor owns it.

It was said above that no man has fully thought out the ultimate consequences of syndicalism of coal. Some evident consequences will suffice for our present discussion.

1. *Wastefulness in Mining*

This comes about from two causes. First, a lack of incentive to conservation. Why should the miner save coal? It is not his coal. He only owns what he mines. There is enough coal in some mine to last him while he wants to work. Then the public of the future, why should he be solicitous about them? They are perfect strangers? Second, lack of Capital. Capital! That is the malevolent thing that they have been trying to get clear of in all this struggle toward liberty. Perhaps the mines are well equipped when taken over. No capital is needed, the equipment they think will last till the coal is exhausted. Earnings are good, wise

operators would not pay it all out in dividends but put some to surplus for depreciations. But the miners clamor for dividends, and cannot see why large dividends are not paid if earned. Month by month the subtle forces of destruction are at work. Poorer equipment makes more costly and decreased production. Decreased output will make reduced profits and reduced dividends. Reduced dividends bring grumbling, then mutiny. Output must be increased and to do it, "easy" coal must be mined wastefully.

Syndicalism makes impossible that heroic work that every great industry does every now and then when managed by shrewd men backed by capital. An interesting instance of such "wrecking for profit" or "wasting to save" is given by Charles W. Schwab in his reminiscences of Andrew Carnegie.

Mr. Schwab had built a new converting mill for the Carnegie Company. When it was done he took Mr. Carnegie out to see it. As they were looking over the mill, Mr. Carnegie said:

"I can see by your expression that you are disappointed. There is something wrong with this mill."

Mr. Schwab answered:

"No, it is just what I told you it would be. But if I had to do it over again, there is one thing which has just recently been discovered that I would introduce, and I am sure it would result in further economy."

Whereupon Carnegie asked:

"Can you change this mill?"

"It would mean tearing this down and rebuilding it."

"That is the right thing to do," said Carnegie. "Tear it down and do it over again."

And although that mill had been running only two months it was torn down and rebuilt, and the return upon the capital thus expended repaid the firm manyfold.

When the time comes when a steam plant in good condition could be replaced with great advantage in

economy by an electric installment, or by installing an equipment for receiving power from a central station, it takes capital to do it. If money could be made by burning their coal in byproduct ovens it takes a good deal of capital. If it is economy of power to throw away old cars and buy ball-bearing cars it again takes capital.

2. *Coal Supply Will Be Absolutely in the Hands of the Miners' Union*

The union now has the monopoly in mine labor in unionized fields. Not a car of coal can come out of a unionized mine except by indulgence of the union officials. The unions then will have a monopoly of coal. The unions reserve the right to strike. What control can be more complete? A strike is both a strike and a lockout, for the union is both operator and miner. A strike against its own award by the union or a strike against nothing in the world, cuts off indefinitely all coal supply except what miners mine for their own use. No such procedure is imaginable it is said. It might help the imagination a little to recall what did take place in the middle of the winter of 1919. The public was not in the tender thoughts of the officials of the union. But in some localities miners, who were suffering from cold, petitioned operators that they be allowed to mine coal for themselves but not for the operators or the people.

3. *Unlimited Wage Fixing*

In the British scheme, "The Mining Council has no power to fix wages except in conference with the Federation of Labor." Imagine, if you can, a Miners' Union coming to a council, one-half of whose members are miners, and making a demand for sixty per cent advance, or any other per cent and any schedule of hours, and being turned down. The miner buys his

own labor at his own price, and passes the cost on to the consumer-public who has no defense.

In fact, the public has a defense. The time would come when senseless strikes and mounting costs would become unbearable, and the people would rise in their righteous strength and sweep away the intolerable oppression, and restore a reign of reason and sane government.

Third. Co-operative Coal Mining

A co-operative coal mining company is as nearly a "democratic" mining company as can be found. As in a democracy, every member of such a company has one vote and only one. The members have an equal interest in the success of the business. Theoretically it leaves nothing to be desired on the part of labor. No profiteering on the fruits of toil. It is the nearest approach we have to "mines for the miners."

There are two kinds of co-operative companies.

1. A company of miners owning a mine and operating it "democratically." This kind of company is rare and the operation small. A company of miners cannot generally raise enough money to buy a valuable mine unless the owning company is in financial distress.

2. A company of miners leasing a mine and working it "democratically."

The method of procedure may be illustrated by the example of a co-operative coal mining company organized in Indiana. By permission of the Outlook some portions of an article written in 1909 by the present writer, who was president of the owning company, will be given.

An experiment was inaugurated in a mine near Terre Haute, Indiana, which has some features that are unique. The plant with which the experiment was made consisted of a coal vein seven and a half feet thick, the mine capable of producing five hundred tons a day and capable of being developed in a few months to double that amount. The mine was equipped

with modern machinery. The mine was near a good market, good coal, conditions of top and bottom such that miners can produce an unusually large amount of coal per day.

The miners were mostly Americans, more than ordinarily intelligent. The miners entered into negotiations with the owners of the mine for a lease for a year, with privilege of renewal. The officers of the mining company agreed to lease on terms most liberal to the miners, in order that they might be encouraged to make the experiment. Looking to the safeguarding of the property, the following provisions were embodied in the lease:

✓ First, the miners shall form a corporation with legal responsibility.

✓ Second, all supplies for repairs about the mine and all labor must be paid in cash. This was necessary so that no labor or material liens could be entered against the property.

✓ Third, the mine must be operated in accordance with best engineering practice. The mine must be kept in good physical condition.

The compensation to the mine owners was to be determined as follows: First, rails, props and other necessary supplies shall be bought out of gross receipts for coal sold. Second, for three months, miners and all laborers employed in producing coal shall be paid in full in accordance with the scale governing the Miners Union in the Terre Haute district before any profits shall be distributed. Third, for three months, the lessor company shall receive one-fourth of the net profits after deducting wages and expenses. If there are no profits the owners of the mine receive nothing for the coal taken out, or use of their machinery. Fourth, after three months, the lessor company shall receive five cents a ton and one-fourth of the net profits after deducting wages and expenses.

The mining company adopted by-laws containing the usual provisions and the following distinctive ones:

1. All stockholders must sign these by-laws.
2. No debts shall be incurred by this Company. Purchases must be made only for cash.
3. The association and members of the association shall be governed by the Terre Haute agreement concerning wages and mine conditions.
4. Every person working in or around the mine shall be a stockholder in the Union Mining Association.
5. Every stockholder agrees to divide losses accruing from the operation of the mine, and hereby instructs the book-keeper of the company to check off his wages any losses which accrue to said company by reason of the operation of the mine.

6. Every stockholder hereby agrees to have the bookkeeper check off his wages the sum of five dollars to pay for one share of stock in the Union Mining Association.

7. Any member shall have the right to give up his membership by assigning his certificate of stock back to the Treasurer of the company. His membership fee shall not be returned to him. Only one share of stock shall be issued to the same member, and each member shall have only one vote.

8. Each member hereby agrees to hold no other member, or the association as a body, responsible for his death or any accident which may befall him during his work in or around the mine.

They started with a membership of eighty-five. The capital stock of Four hundred and twenty-five dollars was too small, but a large capital is not necessary, as the principal outlay of money in coal mining is for miners' wages. And in the matter of wages, the men need not pay themselves till they get the money, but they sold for cash.

They elected seven directors from their members. The directors elected President, Secretary-Manager, Treasurer, and Sales Agent. The only salaried officer was the Secretary-Manager, who received one hundred dollars a month with his salary subject to assessment in case of loss.

The mine ran steadily while other mines in the locality were running three or four days in the week. The first half month the receipts for coal just paid expenses, wages in full, but owners got no profits. The second half month, the receipts paid expenses, miners' wages in full, and sixty-six dollars for repairs. The next three half months the receipts were not enough to pay full wages. The assessment ran one-half month as high as twenty-five per cent. But even at that, owing to greater number of days operated, the amount received by the men was nearly twice as much as men in other mines received. Before the end of the three months they disbanded their organization and surrendered the lease.

Method of Settling Disputes

The outcome of this experiment is disappointing. It is true it was undertaken at a time of depression in the coal business. But the coal, machinery, and equipment were given to them absolutely during the time they continued to operate. The failure certainly is not chargeable to profiteering barons. No doubt such companies, if they succeeded, would solve some of the serious problems of the coal business.

1. If a small minimum royalty is paid the owner, enough to cover depletion, depreciation, and interest, he does not throw away his coal absolutely as he often does in the ordinary way of operating. Also, by a moderate sharing in the profits when they are earned, it helps to compensate him for the use of his money and brains in a hazardous business.

2. It gives the miner for his wages all that the product of his labor fairly brings in the market. In a good market his wages are automatically raised in his increased profits. In a low market he gets more steady work and makes a better monthly wage than is made by other miners working at a higher wage and fewer days.

3. It settles all labor disputes. The hard-and-fast scale fixed by the union, which keeps the men idle rather than allow them to work at a wage which the market can stand, is released. The miners are now free men.

4. It thus conserves two of the most valuable resources of the nation,—life and coal. The owner gets something for his coal. The miner, instead of being idle and losing that many days from his life, redeems the days which he now works instead of being idle.

Some Weak Points in Co-operative Coal Mining

1. It is one thing to be able to mine coal and bring it to the surface, and quite a different thing to manage such a complex industry as the coal business. A striking illustration of that fact was furnished by a partnership formed a few years ago, by five of the most expert mining men in Western Pennsylvania, to operate and manage a mine in the Middle West. The outcome was disastrous; thousands of dollars were sunk in the project, because their experience and skill were below ground, while a mine is managed above ground.

2. Coal mining requires large operating capital to be profitable. Betterments, new devices, new requirements by the government, sales made on time,—all these require a large working capital.

3. Such companies mine wastefully, they do not keep the mine in good condition, they leave coal in the mine that ought to be recovered. The coal is not theirs.

4. The character of a large proportion of mine labor: They do not settle down at one place for a life work; they squander their time and money; if wages are good, they either spend as they go or, if they accumulate some money, they lie off until expenses catch up with profits. Then when times of low profit come, they have no money to supplement scant wages, and they either drift away or become centers of rebellion, and finally wreck the company.

The conclusion seems to be that, except in very exceptional cases in small co-operative companies, the old way of operating is better for miners and owners alike.

A company strong financially, strong in the ability to manage, operate, and market its coal, content with fair profits that the business deserves, paying its men all it can afford while it conserves its coal, conserves its men's lives and furnishes them good living conditions, cannot be matched by the ordinary co-operative company.

✓ *Fourth. A Company-Owned Mine That Is Managed Democratically*

In a nation that is democratic, citizens, irrespective of race, creed, color, or association, are, in matters pertaining to their rights, entitled to representation by men chosen by ballot and given power to speak on their behalf in matters that concern their welfare.

A democratic mining company must, as nearly as the conditions will warrant, assure to every employee, irrespective of race, color, creed, and political or union affiliation, representation with reference to his employment, and working and living conditions.

The Colorado Fuel and Iron Company, in 1916, submitted to its employees a plan, which was adopted almost

unanimously by them, and which seems to have embodied these principles very well.

1. In the matter of discrimination between employees :

There shall be no discrimination by the company or by any of its employees on account of membership or non-membership in any society, fraternity or union.

This is essential in a true democratic industry.

2. In the matter of election of employees' representatives.

The mines of the company are divided into districts. each district elects by ballot representatives, one for each one hundred and fifty employees. Conferences are held between these representatives and the officers of the company at least every four months.

These conferences discuss freely matters of mutual interest and concern to the company and its employees, embracing suggestions to promote increased efficiency and production, to improve working and living conditions, to avoid friction and promote cordial relations between the company and employee.

3. Annual joint meeting of all employees' representatives and officers of the company.

Reports are made by the several joint committees, and matters concerning the common interest of company and employees, requiring collective action are considered.

4. At the beginning of each year joint committees on industrial relations are selected for each district. These are permanent committees, and four in number for each district. Each committee is composed of six members, three selected by the employees and three by the company.

(a) Joint committee on safety and accidents.

This deals with inspection of mines, prevention of accidents, safe-guarding machinery and dangerous working-places, use of explosives, fire protection, and first aid.

(b) Joint Committee On Sanitation, Health, and Housing

This deals with hospitals, physicians, nurses, occupational diseases, tuberculosis, sanitation, water supply,

sewage systems, garbage disposal, street cleaning, houses as homes, rent, gardens, and fencing.

(c) Joint Committee On Recreation and Education

This deals with club houses, halls, playgrounds, entertainments, athletics, field days, holidays, schools, libraries, classes for foreigners, technical education, lectures, churches, Sunday schools, Y. M. C. A., and classes in first aid.

(d) Joint Committee On Industrial Co-operation And Conciliation

They may, of their own initiative, or have referred to them by the President at any time throughout the year, any matter pertaining to prevention or settlement of industrial disputes, terms and conditions of employment, maintenance of order or other differences.

Method of Settling Disputes

(1) Any employee or group of employees having a complaint or grievance may, either directly or through the employees' committee, take it up with the officers of the company. If they fail to adjust the differences, upon request by the employees' representatives, or upon the initiative of the president, the difference shall be referred to the joint committee on industrial co-operation and conciliation of the district, and the decision of the majority of the committee shall be binding on all parties.

This board, it is to be remembered, is equally composed of miners' representatives and company representatives.

If this board cannot agree, they may do either of three things.

First. They may select an umpire to sit with them, and his decision is binding on all the parties.

Second. They may submit the question to arbitration, employees and the company each appointing one and they a third if the two cannot agree.

Third. They may ask the industrial commission of the State to appoint all the arbitrators, or itself arbitrate the difference. This plan, of which the foregoing is a skeleton, seems as near a democratic control as can well be devised, and one which it would, as far as circumstances permit, be well if all mining companies adopted.

It is to be noted that in the great strike in 1915 no demand was made for more wages or better working conditions, but it was an effort by the United Mine Workers to unionize the mines.

By agreement, a board of conciliation has served to secure peace for twelve years in the anthracite coal field.

CHAPTER XVI

THE ANTHRACITE FIELD IN PENNSYLVANIA

Little Need in This Field for Control of Waste—How the Anthracite Coal Was Saved from Erosion—How It Became Anthracite from Lower-Grade Coal—Description of the Four Fields—Causes of Former Waste: Cheap Land, Crude Way of Mining, Cheap Royalty, Ignorance of Value, Small Commercial Value, Because It Would Not Burn, Because It Was Hard to Get to Market, Then Overproduction and Waste—Methods of Reaching a Market in Cities, From Northern Field, Schuylkill Field and Lehigh Field—Efforts to Control Production and Price-Cutting — Miners Produced Intermittently — Railroads Pooled Coal—Railroads Purchase Coal Land By Indirection—Control a Large Part of Independent Output By the "65 Per Cent. Agreement"—Causes That Have Been Eliminated—Low Cost of Land—Cost of Weak Companies in Anthracite Mining—Sinking Mine—Thin Veins—Pumping—Taking Care of Water After It Is Pumped—Props and Support for Roof—Supply Boiler Water—Ventilating—Fighting Fires—"Manufacture" of Coal—Workmen's Compensation—Modern Conveniences—Duration of Life of Anthracite.

I have deferred treatment of this anthracite field till now, because avoidable waste in mining has been practically eliminated in the entire field. If so, government control to stop waste is not necessary. To the public in general it is a surprising statement that anthracite mining does not need regulating.

The anthracite operators have been the most investigated people in the United States. Some members of Congress are very fond of investigating something. If they can think of nothing else to investigate, the proposal to call the anthracite Barons to account strikes a popular chord. They recall the report of the Pennsylvania Commission, appointed in 1893 to investigate waste in mining that up to that time a ton and a half of anthracite had been wasted or left in the ground for every ton that was produced.

They charge that railroads own ninety-three per cent of the anthracite coal now unmined, and control all the

coal except three per cent; that they combine to limit output; that they agree among themselves to fix prices.

All these statements are true, and probably more abhorrent things. Yet, in face of it all, we say, government control is not needed in the same sense in which it is needed in most of the bituminous field. It is necessary, therefore, briefly to review the history of anthracite mining the difficulties surrounding its early development, which led to waste, confusion, loss, and bankruptcy; its struggles toward a stable and sane industry, and the final evolution of the present monopolistic control.

We shall then be in position to answer the questions: "Are present conditions warranted,—should government intervene to change conditions for the better?"

In order that we may better be able to follow the discussion, it is necessary to give a brief description of the anthracite field.

The Pennsylvania anthracite is the small remnant of a very large area of coal land that covered the present anthracite fields and extended to the north and west over an area at least five or six times as large as the present field. This area was comparatively level and covered with numerous veins, probably more than are left in the deepest part of the anthracite field. The coal was not anthracite but coal at an earlier stage of development,—bituminous, or even lignite and peat.

Then came the time when a great thrust in the crust of the earth set in from the southeast, creasing that entire area into waves of rocks with their included coal veins.

Then came the great ice sheet, which, moving down from the north, and northeast, like a great carpenter's plane, sheared off the tops of the ridges and the other high-lying areas, carrying with it the easily eroded rocks and coal. Fortunately, areas totaling about four hundred and eighty-four square miles in extent lay deep down in the folds between ridges of very hard rock, which resisted the cutting plane and saved four detached fields from destruction.

The coal thus saved was transformed into anthracite, as the result of these great movements, either according to the generally accepted theory, by being robbed of a large part of its volatile matter by a coking process from the heat generated by the thrust pressure, or losing its volatile matter by a gradual "evaporation," through the cracks in the overlying crusts. By this upheaving and eroding process, the entire field is divided into four principal basins, each surrounded by a rim of mountains:

(a) Northern or Wyoming Field, extending nearly east and west, which contained originally a hundred and seventy-six square miles.

(b) Eastern Middle field, lying about fifteen miles south and southwest of the Wyoming Field, which contained originally thirty-three square miles.

(c) Western Middle Field, containing originally ninety-four square miles.

(d) Schuylkill Field, south and almost parallel to the western middle field originally containing one hundred and eighty square miles.

For trade description, the entire area is divided into three fields:

(1) Wyoming.

(2) Lehigh, including Eastern Middle Field and the part of the Schuylkill east of the Schuylkill River.

(3) Schuylkill, including the Western Middle Field, and the part of the Southern Field lying west of the Schuylkill River.* (See Map.)

The Pennsylvania anthracite field, small as it is compared with the various bituminous areas, is the largest, most valuable proved field of anthracite in the world. In fact, most of the so-called anthracite of which we read is not anthracite at all, according to the Pennsylvania standard, but semi-bituminous, or some other coal of higher volatile content.

Knowing its limited amount and high intrinsic value, we would wonder that there should have been waste and need of control in the past.

1. *Some Causes of Excessive Waste in the Early Mining*

(a) Cheap coal land. In the latter part of the Eighteenth Century, land was cheap everywhere. The land in the anthracite field that was bought was rated at its value for farming. Land near what is now Scranton, in the heart of the Wyoming basin, underland with eleven veins of coal, including the mammoth vein forty to fifty feet thick,—was bought for four cents an acre. The Connecticut pioneers paid two or three dollars an acre in the region of Wilkes-Barre, because it was more fertile. It was at least forty years after the discovery of coal before it commenced to add any value to coal land. Even if the owner had known that his land was coal land, it would have affected him but little as the coal was not rated as of much, if any, value.

(b) The very crude method of mining was most wasteful. As late as 1812 the coal was worked by openings in the outcrop, and the coal was hoisted in buckets by rope and windlass, worked by hand like the "Old oaken bucket that hung in the well." It was eleven years after when power was furnished by a horse working a gin. The openings could not be driven on the steep slopes more than twenty-five or thirty feet without the water coming in, so that it could not be further operated. Then it was abandoned and a new opening made.

(c) Very cheap royalty after real mining commenced. An example is given of a lease in 1814 by the Lehigh Coal Company to White, Hazard and Hanto of ten thousand acres for twenty years, at a rental of an ear of corn per year, if demanded. Of course the Lehigh Company believed that coal was so cheap and transportation and marketing the coal so difficult, that it was worth the output for twenty years, if the lessees would overcome those difficulties and at the end of the lease turn over to it a going

profitable concern serving a good market. Nevertheless, no such lease can do other than invite wasteful mining of "easy" coal.

(d) Ignorance of the real value of "stone coal." The name "stone coal" has not been entirely discarded, though we are more likely to use the name "black diamond."

When writers undertake to tell where anthracite was discovered in this or that field, they would better say when the black stones were found to be coal. It is probable that blocks of the anthracite were not so uncommon in these fields. When these basins were formed, the shearing of the coal from the tops of the mountain rims surrounding them left the strata of coal exposed on the slopes of the mountains. From these, blocks of coal would be broken off and washed down toward the streams that were now cutting their channels through the various fields. The streams and rivers would cut through the veins that lay near the surface, and thus expose the "black stone" along the sides of the channels. The first recorded finding of anthracite seems to have been on the banks of the Susquehanna.

Though this discovery was made in 1762, no report of any use of the coal is given until seven years later, so little was it valued as a fuel.

The discovery made in the Schuylkill field in 1770 that the black stone would burn is said to have been accidental. A hunter built a fire on some rocks and went to sleep. When he awoke he found the rocks a glowing mass of fire.

(e) Small value of anthracite as a commercial product. Unless the coal can be taken to a market, and be used there, and if it can be used only in a limited local market by blacksmiths, there is little incentive to careful recovery of a product of value so small. Some of the difficulties in making it a valuable commercial product are as follows:

(1) Difficulty in introducing anthracite as a domestic fuel. The first successful attempt to burn anthracite was made in Wilkes-barre in 1769, by a blacksmith, Obadiah Gore. Six years later a cargo of Wyoming coal was floated down the Susquehanna River to Harrisburg and hauled in

wagons to Carlisle to be used in making arms for the Revolutionary Army. While the use of anthracite in a forge under forced draft made considerable progress, it was necessary for the producers to set up grates in public houses to show that it would burn in ordinary grates. The Lehigh Coal Mining Company, operating in the Lehigh Field, experienced the same difficulty. In 1803 six arks of coal were sent down the Lehigh River for Philadelphia and great difficulty was experienced in selling the two arks that escaped wrecking in the river. The City of Philadelphia finally bought the anthracite for use at their water-work, but could not get it to burn, and put it on their walks for gravelling. In the Schuylkill field as late as 1812 George Shomaker, of Pottsville, hauled nine loads to Philadelphia. He succeeded in selling two, and had to give the other seven away. The men to whom he gave the coal sought to arrest him as a swindler who was trying to sell stone for coal. Disheartening as was this experience, one of the two loads, which he sold for cost of transportation, produced far reaching results. Messrs. White and Hazard bought a load. White spent all morning trying to burn the coal. He gave it up in disgust and shut the furnace door. When he came back later the heat was so great that the furnace was in danger of melting. The proof that the coal would burn was complete, and White and Hazard afterward engaged extensively in anthracite mining.

(2) The early difficulty in getting the coal to market. From the southern end of the Wyoming Field shipment was made by the Susquehanna River.

They shipped their coal in arks holding sixty tons, but about one ark out of every three either sank to the bottom or was grounded on the rapids.

Also, as it was not possible to go up the river, they had to knock their arks to pieces and sell the wood for fuel. As only fine timber could be used in building the arks, and only firewood prices could be realized in market,

it was expensive to build an ark for every sixty tons started to market, one-third of them to be wrecked and two-thirds sold for firewood. From the northern end of the Wyoming field, the Wurtz Brothers tried to ship their coal from the Carbondale Mines by way of the Lackawaxen and Delaware Rivers to Philadelphia; but the cost of hauling from their mines to the Lackawaxen, together with the cost and danger of river transportation, was too great.

The Lehigh field experienced the same difficulty in getting coal to market. Out of six arks of coal sent down the Lehigh River by the Lehigh Coal Mining Company in 1803, only two reached their destination.

(f) Efforts to cure these difficulties finally bring wasteful competition. Gradually the people began to understand how to burn the coal, and a ready market was found in the cities.

It was impossible to reach the markets with the present means of transportation. The first attempt at a solution was by a combination of gravity, railroads, canals, and rivers.

(1) To reach New York from the northern basin, the combination was a gravity railroad sixteen miles long from Carbondale to Housedale, a canal to the Hudson, and by the Hudson to New York.

(2) To reach Philadelphia from the Lehigh field the combination gravity railroad nine miles long, a canal forty-six miles long, a canal forty-six miles long to Easton, and the Delaware River to Philadelphia. A curious mistake was made in the last link of that combination. The Delaware locks were smaller than the canal locks, and coal for Philadelphia had to be transshipped at Easton.

(3) To reach Philadelphia from the Schuylkill field there is but one link in the transportation: a canal one hundred and eight miles long, from Pottsville to Philadelphia.

These lines of transportation, which were based wholly or in part on water transportation failed at the most critical times. Floods washed away dams, and when demand

was greatest in winter, freezing water cut off transportation. Then came railroads; until the entire field was covered with a network of trunk lines and switches.

Now that transportation was equal to every demand, and that difficulty has disappeared, the great bane of the whole coal field began to work its ruin,—overproduction and reckless price-cutting.

At that time it cost little to open a mine. The coal outcropped along the slopes of the rims of the basins. The railroads that were then sending out spurs in all directions were eager for freight, and encouraged the opening of a mine wherever it gave promise of furnishing more freight. Over development and price-cutting brought their usual crop of financial distress. To add to the distress, many purely speculative companies were organized.

They paid high wages, opened mines wastefully, overdeveloped the industry, claimed large profits and on the strength of their large output and inflated profits, sold out just when overproduction was beginning to bring its inevitable result, ruinous competition and with it waste.

Operators could not stop producing, as overhead and interest charges would drive them into bankruptcy; but the more they produced the worse. Because the Civil War,—when it came,—caused temporary relief. Anthracite prices advanced to two and three prices of normal times. Profits were large. Then came the usual result,—many new mines were opened and railroads built to them.

When the war ended, prices collapsed and fell to half their normal rate.

II. Methods Adopted By Miners, Operators and Railroads to Bring Order and Stability Out of This Chaos

(a) Miners voluntarily reduce production until demand catches up. The miners would not have their wages reduced to meet the reduced price of coal. They didn't call

it a strike but just a suspension of work until the surplus was used up and a demand came for more coal, then they resumed work at the old wages.

This prevented further decline in the price of coal, but it did not much help the operators; cost of idleness had to be paid and no profit. Then began the movements that by many devious ways have reached the present monopoly by the railroads.

(b) Pool of Railroad freight. This was the first experiment in control. The railroads (1) made an estimate of the amount of coal that would be needed at competitive points, as at tidewater. (2) They divided this amount among themselves according to the amount of coal produced on each road. (3) They fixed prices at these competitive points which gave operators and railroads a profit. (4) They fixed a fine of \$1.50 for every ton that any railroad shipped beyond its quota. This pooling arrangement worked fairly well for three years, at the end of which time it was dissolved. Then followed a renewal of former conditions of overproduction and waste.

Prices fell very low; four railroads suspended dividends, and the others paid small dividends. For twenty-five years, up to 1898, the anthracite field was the scene of successive pools, "gentlemen's agreements," followed by dissolutions, disaster, and waste. Operators saw their coal wasted and themselves in a constant state of incipient bankruptcy. The railroads saw the freight upon which their life depended being wasted and their patrons impoverished. These temporary expedients have proved inefficient; some radical change must be made.

(c) Purchase of coal lands by the railroad combine. It would do the railroads no good to own coal land, if they cannot mine and sell the coal.

The present Constitution of Pennsylvania prohibits a railroad from mining and selling coal, except where its charter granting it that right antedates the Constitution.

The Lackawanna and Western is the only railroad in that field that could own and mine its own coal, since its charter granting that privilege antedates the Constitution.

The only way open to the other railroads was to do by indirection what they could not do directly. That indirect way was to own in combination a corporation with charter rights broad enough to enable the roads through it to buy land, mine coal, and market it. The history of the way in which that object was accomplished is very interesting but it would carry us too far from our present purpose. A most interesting account of the whole transaction is given by Elliot Jones in "The Anthracite Coal Combination." the y formed the Temple Iron Company, whose amended charter gave the right

to purchase, lease, hold, mortgage real estate and mining rights, prove and open mines, prepare and transport coal to market, and dispose of the same, and do all such acts and things as a successful and consistent prosecution of said business may require.

By use of this company they gradually bought coal land and mines until they owned ninety-three per cent of the anthracite field.

(d) Make with independent operators a perpetual contract to buy all their output at a fixed percentage of the selling price.

This is what is generally called the "sixty-five" per cent contract, because all coal above a certain size called "pea" coal is to be paid for at sixty-five per cent of its selling price near New York, though smaller coal carries a less percentage.

The principal terms of the contracts are as follows:

(1) The seller sells and agrees to deliver on cars to the buyer all the anthracite coal hereafter mined from any of its mines now opened or hereafter opened or operated.

This Section is like the proposed contract with the selling agencies in the bituminous fields.

(2) Shipments to be made from time to time as called for by the buyer. The buyer to arrange to take coal, as nearly as possible, in equal daily quantities. To try to find buyers so that each mine shall have as many days work as other mines similarly situated.

This Section limits output to demand, aims to cure the industry of its spasmodic production, and to spread the production over the entire field.

(3) The buyer agrees not to discriminate in favor of one mine over the other, but shall order monthly a just proportion from each, of the entire quantity agreed upon by the buyer.

Our proposed selling agency in the bituminous field is required to do like justice to each mine.

The next Section is the sixty-five per cent Section, and is the price controlling contract. It appears, therefore, that the railroads, (a) have a monopoly of the anthracite mining industry. (b) In doing indirectly what, if done directly, is illegal, mining and selling coal through the mining companies whose stock they own or control or through the holding companies which nominally own both the roads and their affiliated mines. (c) They limit and control output. (A certain Mayor some time ago wrote to the President and charged that anthracite mines were not operating to capacity, and asked for an investigation to see if they could not be compelled to operate full time. He is representative of the many who want all our resources used up as fast as possible whether they are demanded for economical use or not.) (d) They regulate and fix prices. No great industry, like the anthracite mining, can continue to live if it does not return a fair compensation to producer and a fair wage to labor. The cut-throat prices that ruled at times in this field ruined operators, made them unable to pay decent wages to labor, did not, in the long run, benefit consumer, and wasted the coal.

Any fair-minded man, after comparing the past with the present in the anthracite field will agree that railroad control has been its salvation.

(1) The railroads are benefited both in the stability of freight conditions, and in the increased life of the industry and longer continuance of their profit from freight.

(2) The independent companies are benefitted, since they have a well-regulated production, a fair price for their coal, are saved the cost of a selling agency, and have their coal marketed without worry.

(3) The public is protected. The railroads have their coal mined carefully and skillfully, and thus conserve it. The independent operators mine their coal economically without waste; they get a price for their coal that enables them now to take out all the coal which can be mined at all. The consumer does not pay on the average as much as he would have to pay in an unstable market.

Mining anthracite coal now is a science. Only men skilled in meeting the special conditions here can do the work at all. Only strong companies under most capable men can afford to mine in this field. Are these powerful companies doing all that can be done to conserve coal?

The three causes of waste which were mentioned in connection with mining in the bituminous fields and which were present in the anthracite field in the beginning are absent now:

(1) The coal land is too valuable to be wasted. "We are mining coal almost regardless of cost," says one Superintendent.

(2) The operating companies are strong financially, and are not forced to mine easy coal to keep out of the hands of the Receiver.

(3) By agreement to limit output, prices are kept at a high enough rate to justify economical methods in the mine.

The following are some of the difficulties in anthracite mining and the various sources of cost, which have to be met:

(1) The expense of sinking and equipping a modern mine. Most of the field can be worked from mines already sunk, but when a shaft has to be sunk, it has now

to be located in the most difficult and hazardous site. The difficulty encountered in sinking a shaft now is illustrated by the experience of a company which sunk a shaft a few years ago in the flat lands of the Susquehanna River, which are only a few feet above water level and are overflowed every year. The borings showed that they must go through sand, gravel, and quicksand. After going a little below the surface they found that water stood in the shaft at the river level, and that water coming in through the gravel and sand could only be kept out by a concrete lining seven feet in thickness and one thousand feet deep. After the coal is reached, the expense is by no means ended. Millions of dollars are now needed to reach the lower veins, where thousands were enough to reach the shallow veins that are now exhausted.

(2) The difficulty and expense of mining the thin veins. Thin veins, which would not have been touched in the early mining, are now being mined. In veins two-and-a-half feet thick the gangways and main haulage-ways have to be made of standard height and width. This necessitates the mining of large amount of rock and taking it up out of the mine. Rock mining is very expensive. About thirty per cent of the coal that is being mined in the northern field is in veins two-and-one-half feet thick. Another large increase in the cost of mining thin veins is in the large labor cost. The output from a thin vein is much less in a day than from a thick vein. The miners have to be paid more per ton. Operators can only afford to mine such veins at all by mining at the same time thicker veins and averaging the cost.

It is mine the thin vein now or never! They cannot afford to come back after the thick veins are mined and take the thin veins; besides, they will probably be wrecked in mining the thick veins alone.

Mr. Dorrance, Superintendent of the Hudson Coal Company, said;

I went into a mine near Scranton to look it over with reference to spending some money to clean and prepare the coal from that mine. There is nothing left in that mine except one vein of coal, and we walked the whole morning, looking at the quality of that vein. Out of the six feet which would have to be mined, there was a foot and a half of coal. Out of the six feet which had to be mined, less than twenty per cent was coal which could be sent to market. The cost of production is five times what it would be if the vein were all coal.

(3) Taking care of the water in the mines. To pump the water from the mines, nine hundred powerful pumps are at work, some of them costing \$30,000.00. They are capable of hoisting five hundred billion gallons a year. In addition to the pumps, some of the mines use immense tanks holding from two thousand to three thousand gallons each, which may be hoisted every forty seconds. After a vein is exhausted, the water originating in it must be pumped out continuously, because it finds its way to the lower veins that are being worked, or may break through and swamp veins on the same level. For every ton of coal, now mined, on the average thirteen and a half tons of water must be hoisted. In times of heavy water from melting snow or flood, mining is suspended, and all the steam-generating capacity is used on water alone. Sufficient horsepower is used at the anthracite mines to drive at full speed continuously all the battleships of our navy. One-eighth of all the coal mined is used up to make steam. In addition to the pumps, the drainage pipes that bring the water to the pumps are an enormous expense, not only first cost but cost of renewal, since they are constantly being eaten up by the sulphur in the water.

(4) Taking care of the water after it is out of the mine. It must not pollute watersheds, streams, or rivers. Settling tanks must be provided so as to reduce the sediment. Enough water has to be taken care of in a year to fill a river one hundred feet wide, ten feet deep, and reaching from New York to the Rocky Mountains and back.

(5) Cost of props and supports for the roof. Timber near the mines is exhausted so that timber has to be brought from the South. It costs at least \$10,000,000 a year to buy and haul the timber, and \$20,000,000 to put it in place. They are now putting in steel props that cost four times as much as wood. Tunnels long enough to reach through the earth have to be kept propped, to keep haulage ways and air ducts open, and to protect the surface from subsidence. Even at that, the problem of surface support is now a very serious one. Where the "mammoth" vein, 40 to 60 feet in thickness lay near the surface and has been removed, it has been impossible to sustain the surface. In Scranton, schoolhouses and other buildings have collapsed. The only remedy seems to be to flush the mine full of culm, or sand, at a cost of about \$2,000 an acre.

If government control had been properly exercised, two things would have been in force. First, pillars in the different veins would have been columnized,—that is, the pillars and props in the lower veins would have been placed directly under those above, which they were not. Second, the city of Scranton would have been located on one side of the coal field instead of on it. Such location is said to be equally adapted for a city.

(6) Supplying water for the boilers. The water from the mine cannot be used in the boilers on account of the impurities, which would destroy them. The pure water has in many cases to be brought long distances at great expense.

(7) Ventilating the mines. Air has to be carried through all parts of the mine, even the parts which have been exhausted, to sweep out the gases and to supply a sufficient quantity for every living being in the mine. The mine law requires that the anthracite miner be furnished with two hundred cubic feet of fresh air per minute. In order that no part of the mine may become charged with gas, double that amount is often furnished. In order to provide against accident and to keep the current moving

while repairs are being made, triplicate systems of fans are installed. Two fans may thus become disabled, and ventilation be kept up by the third.

(8) Fighting mine fires. The Lehigh Coal and Navigation Company spent during six years \$460,000 fighting fires. In one mine a concrete dam eighty feet long, forty-five feet high, and eight feet thick was built, in order to flood the fire regions.

(9) Manufacture of the coal after it reaches the surface. The coal at the surface is by no means fit for market. It is a mixture of coal, bone coal, and slate. A writer says of one mine:

Two boxes of straight impurities were hoisted from the mine for every box of coal. Even of the coal that was dumped forty-eight per cent was eliminated by the breaker as slate and refuse. The coal finally reclaimed was only one-sixth of the material that was hoisted out of the shaft. The pile of "gobs" from the mine was simply tremendous. It extended for several thousand feet to the height of three hundred to four hundred feet, and was several hundred feet broad.

Fully one-fifth of the cost of mining and preparing this coal for market comes after it is above ground. For the "manufacture" of the coal in the anthracite region there are about three hundred breakers. These breakers crush the coal into the various sizes that are put upon the market, and in course of the breaking remove the impurities by washing, or picking, or screening until it will pass the inspector. Each size of coal is inspected, to see if it has more than the prescribed percentage of slate. If it has, it must be sent back to the breaker and recleaned. These breakers cost from \$300,000 to \$500,000 each. The life of a wooden breaker is about eight years; the iron posts may be eaten up by the sulphur in a year.

(10) Cost of workmen's compensation. Anthracite mining is very hazardous. Men may be caught in the rim of a vein on a steep slope. Reclaiming pillars anywhere means many falls of roof, but on the steep slopes it is doubly dangerous. Men, too, become careless and take

chances; eighty per cent of the accidents are due to carelessness or disobedience of direction. One company, which mines eight millions tons a year, estimates its compensation insurance cost at \$500,000 or 15 to 20 cents a ton of coal mined.

(11) Cost of modern convenience about a mine. Above ground: wash-houses, dwelling houses, probably of brick or cement, with hot and cold water, bath rooms, and electric lighting. It is not uncommon to hear speakers berate operators for the hovels they rent to their men at a high rate, and condemn the cesspools and unsanitary surroundings that endanger life and health. These violent speakers have probably never visited a modern anthracite mine, or else do not care to tell the truth.

In the mine is the greatest change from the olden times. Fire-proofing, haulageways, fire engines, hospitals and appliances for first aid, and men trained to use them. Telephones are everywhere for call; one company has fourteen hundred of them.

The syndicalist who proposed to operate these mines needs gird himself to do a big man's job.

The accompanying map shows the way the veins lie in most of the mines, especially in the Southern field.

Life of the Anthracite Field

Various attempts have been made to estimate the original content of the anthracite field and the number of years until the coal will be exhausted.

The method of making the estimate is to take each of the various veins and compute the amount of coal it originally contained, then add the results.

The data for the computation of the content of each vein are average thickness of the vein and its area.

The average thickness of a vein is found by taking the thickness of that vein in all the bore holes, shafts, and tunnels that cut it, and assuming that the average found from these is the thickness over its entire area. The area

is found by finding the limits of the vein at the outcrop, or at the edges of it, as shown by borings and shafts.

One of the most complete estimates is that made by J. P. Lesley in 1893. He estimated the original content of the Northern basin to be 5,700,000,000 tons; Eastern Middle, 600,000,000 tons; Western Middle, 4,000,000,000; Southern, 9,200,000,000, or a total of 19,500,000,000 tons.

He estimated that, counting that one and a half tons had been lost for every ton produced, the depletion up to 1893 had been 2,255,000,000 tons, leaving in the ground 17,245,000,000 tons. The output since that time has been 1,950,000,000 tons, so that the depletion has been about 4,000,000,000 tons, leaving now 13,245,000,000 tons in the ground. Lesley assumed that forty per cent would be recovered from his estimated amount. If we assume fifty per cent recovery, the possible future production will be 6,622,500,000 tons.

The annual production has been more than 80,000,000 tons in the last few years. Assuming that rate for the future, the field would be exhausted in eighty-three years. It seems that the peak of the production has been reached, and the output will soon gradually decline. The decreased annual output will lengthen the life of the field, but cannot increase the ultimate quantity of the coal. Every ton of annual anthracite decrease will throw that much greater demand upon the bituminous fields.

The railroad mines are conserving their coal by taking about twenty per cent of the output from the independent mines. At that rate the independent mines will be exhausted in about fifteen years. One large railroad company estimates that it has a supply for one hundred and sixty-three years. If so, it will be mining its output of 8,000,000 tons a year long after other mines are worked out.

CHAPTER XVII

PROPER USE OF COAL AFTER IT IS MINED

Proper Use of Coal After It Is Mined—Difficulty Arising from Great Diversity of Use—Burning Raw Coal Wasteful—Feed the Furnace—Training Firemen to Save Coal—Burn Coal Before Burning It—Beehive Oven Saves Only Coke in General—Gas Producer, Turns All the Coal Into Gas—Advantages of Gas in Furnace—Advantages in Engines—Byproduct Ovens, Save Coke, Gas and Byproducts—Two Ways of Treating the Gas: Coaling and Heating, Cooling Only in Feld Process—Use of Byproducts: Fertilizer, Motor Power, Dyes, Drugs—Effect on Labor—Methods of Increasing Efficient Uses of Coal.

It seems a hopeless task to do anything in a concerted, helpful way to conserve coal in the vast field of coal consumption. It certainly is hopeless, if we do not mix our fine theory with large practical common sense. In this great diversified coal industry scattered over vast areas, in rural districts and urban districts, near railroads and remote from them, no single plan can be applied. But if there are abuses in the use of coal, or wasteful ways that ought to be remedied, and a plan can be devised and carried into effect that corrects those abuses even in a limited field, it is worth while. In time changing conditions may render it possible in other fields. The whole people, as we have shown, have an interest in conserving the coal supply. To its full extent, lack of scientific use of coal in consumption defeats the results of conservation in production. It is not the design of proper conservation to limit the output of consumption in the way of comfort to the domestic user and profit to the industrial user, hence the more coal it takes to do the same work the greater the drain on the supply.

Burning of "Raw Coal"

Most users of a small amount of coal have given little thought to the proper burning of their fuel. In the home,

if the number of fires do not heat the house properly and cook the food well, more stoves are put up and more coal is piled on. In the majority of small factories little thought is given to the efficiency of the furnace and boiler. Coal has been so cheap that the burning of a few bushels more or less makes little difference in the manufactures' cost account. Besides, they do not know whether their furnaces are properly made or whether they are adapted to the kind of fuel they are using. They do not know how to test them, and either have no faith in experts or do not want to incur the expense of calling in a specialist. The result has been that in some cases not more than five or ten per cent of the heat value in the coal has been used productively.

Matters, on the whole, however, have been improving. Even with coal at the low price at which it has been bought in the past, companies that use hundreds of thousands of tons in a year have come to see that it is a serious loss to waste a large percentage of the coal. So, they have installed automatic stokers, employed skillful managers, and employed specialists to advise them how to adapt their equipment to the coal and how to use the coal with greater efficiency. Some coal companies employ expert fuel engineers, who are ready to go to the different plants that use their coal and show the owners how to equip and use their plant that is burning the special kind of coal they mine. Now, since coal has become dearer and will continue to grow dearer, the incentive to more efficient use of coal will grow stronger, and conservation will be promoted.

The Bureau of Mines has taken a step that is good so far as it goes. A Bulletin has been issued explaining as far as possible the best way to burn coal in furnaces. It shows that we, as a nation, are becoming alive to the interest the whole people have in this form of conserva-

tion. Some who get the Bulletin read it, and are interested, may follow its suggestions. A second step is necessary, as I shall suggest later.

Feeding The Coal To The Furnace And Grate

Hand firing by shoveling the coal into the furnace is the original way of firing, and even yet it is the general way. Efforts to lessen the smoke menace and waste led to training the fireman to become a scientific expert. Schools for firemen are established by some railroads, where expert instructors are employed. Automatic stokers have reduced coal and labor costs, made the use of finer coal possible, and made it easier to control the rate and constancy of firing. Powdered coal has been used in some furnaces, promoting complete combustion, and saving labor and fuel.

All burning of raw coal for its heat content only is wasteful. So nearly is that statement true universally that its use is warranted. We have not been able to use economically one hundred per cent of the energy content of coal, and probably never will. Every pound of coal has just a certain amount of heat energy locked up in it. No device can be invented by which more energy can be extracted than that certain content. All we can do is to employ all possible means by which we can come as near as we may to getting out and using that certain content of value. This we are in duty bound to do and to compel others to do with the coal, they use.

When we speak of the energy content of coal, of course, we only speak of the energy and value that are shown by our chemical and physical tests. Sometime someone may find the key that will unlock the great energy bound up in the atoms and teach how to use it. When that time comes, the duty to use it economically will lie upon the users of this great energy, just as it lies upon us to use economically our limited supply of energy. Abundance is

no excuse for waste. It may well be, however, that posterity may have new uses for energy of which we do not now dream.

Burn Coal Before Burning

This looks like the saying of a jester, or an idiot. But it is literally true that double-burning is the best way to burn coal. I reserve the full description of the equipment and method of operation till later, and only treat here the three ways of double-burning that we may pass upon their use and value and hence the need, or the opposite,—for Government control or encouragement and help. The three ways are:

1. Bee-hive coke oven. The first burning in this case is for the sole purpose of making coke. All the volatile content of the coal is distilled is ordinarily allowed to escape directly into the air. The residue is carbon, and of course the ash of the coal. The carbon or coke is very valuable, especially for use in metallurgy. If there were no other way of melting iron serving the other purposes to which bee-hive coke is put, and no other way of getting as good coke,—much as we deplore the waste of the very valuable products that are sent into the air,—we might accept it as one of the necessary evils, the less of two evils. But there are other ways that accomplish the same result and save the valuable products now being wasted. Some companies are now carrying the heated gases to their heating equipment, and are thus becoming coke and gas companies by saving the volatile content of the coal.

2. Gas producers. These are indeed properly named “gas producers.” In the bee-hive oven the object is to get clear of all gas and leave only coke. Here the whole object is to turn *all* the coal into gas. The only residue is the ash, which cannot be turned into gas. If the gas producer is working well, all coal put in it is changed into *useful* gas. If an ordinary coal fire is working well, it

burns all the coal put into it into *useless* gas. The gas that goes up the chimney from a properly burning grate should be as nearly as possible burned-out or satisfied gas, such as carbon dioxide. The gas that comes out of the pipe in a gas producer must be as nearly as possible unburned or unsatisfied gas, such as carbon monoxide, which is unsatisfied until it burns, that is gets for each molecule of CO another molecule of oxygen and becomes CO₂ when it is satisfied, and will burn no more; and hydrogen which is unsatisfied until it gets oxygen to turn it to water vapor.

Suppose, now, that the gas-producer oven has done its work of turning the coal into gas, the gas comes out of the oven ready to be used. There are, in general, two ways in either of which it may be used. It may be piped directly to the furnace to be burned to furnish the heat for the same purposes for which raw coal is usually employed. If used in this way nothing is taken out of the gas. It is carried to the furnace hot and tarry.

*Advantages of the Use of Producer Gas Over Raw Coal
in Direct Burning in the Furnace*

1. Gas may be burned in the furnace without smoke. In a furnace fired with coal the hydro-carbon vapors are disengaged as soon as the fire is started and are not burned but go up the chimney, and not only make objectionable smoke but carry the heat value of the hydro-carbons away unused. 2. With gas there is less waste of heat up the chimney in another way. If the fuel on the grate is deep and the air draught not strong, the fuel is not all burned completely but a considerable quantity of carbon monoxide is formed, which goes up the chimney unburnt and is wasted. If the fuel bed is shallow and a sufficiently strong draught to produce complete combustion, there must be about three times as much air introduced as can be chemically united with the fuel. Therefore, a large amount of

nitrogen and the oxygen which cannot unite with carbon must be heated uselessly, and thus carry away several times as much heat as a like burning of gas would.

In some high temperature furnaces fired with solid fuel, it is estimated that only five to ten per cent of the heat value of the fuel is actually used. In most cases the heat losses by direct firing may be four or five times as great as by gas firing. . . . On the average one ton of coal in the gas producer will develop as much energy as two and a half tons in the ordinary steam plant.

Heating Uses for Which Gas Is Superior to Coal

First. Use in furnaces which require a uniform heat for a heat regulated in any special way. Valves may be set to furnish gas in uniform quantity for constant heat, or be opened and closed at will for any required variation in heat.

Second. Use in deoxidizing metals. By reducing the supply of air in the gas, the gas may not contain enough oxygen for complete combustion. Now, let it come in contact with oxidized metal, such as bars of rusted iron, it attacks the iron oxide and takes away the oxygen which had combined with the surface iron and cleans the surface.

Third. Uses where the material must be heated gradually and then cooled gradually. The following quotation from Dawson and Harters "Producer Gas" will illustrate this point:

In many operations, such as annealing glass or wire, the enamelling or glazing of various materials, it is necessary to heat them gradually till they reach a high temperature, maintain them at that heat for a time then cool them gradually. It is usual to do this in a chamber and the oven or chamber is gradually heated to a higher temperature then allowed to cool for each charge of material treated. This involves a considerable loss of heat. The wear and tear of the oven is excessively great owing to the frequent expansion and contraction of the brick work and its injury by hard firing to get the heat up to the maximum.

Mr. Dawson designed a continuous furnace for the purpose of carbonizing large blocks of material for use in electrolytic work, which obviated this objection and difficulty. The design consisted of a long furnace heated to a high heat by gas at the middle. The hot products of combustion traveled from the middle to the charging end of the furnace, growing gradually cooler as they neared the end. The far end of the oven was not heated at all. The blocks to be carbonized were carried on wagons, which were protected from the excessive heat by a special device. The whole furnace was kept full of wagons pushed into and through the furnace by a hydraulic ram. Each wagon as it entered encountered a moderate heat that grew stronger until it reached a maximum at the middle, and cooled gradually until it reached the far end. The rate at which the wagons traveled was gauged so that the work was done by the time it reached the middle of the furnace.

Advantages of Gas Over Steam in Engines

The gas as it comes out of the gas producer is not fit to be used in an engine. It is too hot. If it is to be burned in a furnace, the hotter it is the better, but for use in the engine it must be cooled almost to atmospheric heat. It is also too tarry and full of hydro-carbons. These are valuable in gas that is to be burned in a furnace, but they clog the pipes and the chambers of the engine. Hence, for use in engines the gas must be cleaned and cooled in scrubbers, which makes a gas engine plant more complicated and expensive than a metallurgic gas plant. Yet, withal, it still maintains various advantages over a steam-engine plant.

1. Gas producer may be at considerable distance from the engine. If various engines are used in a plant, each engine ought to be as near as possible to the work it is to do. If it is far from its work, many and long shafts or belts are necessary, each using up energy and each liable to get out of order and certain to wear out. In a

steam plant the engines ought to be near the boiler; steam sent long distances in pipes cools and loses by condensation. In a scattered plant the engines cannot be both near work and near the boiler, so there is loss whichever evil is chosen. Gas from a producer may be carried to a considerable distance. It does not condense, and loss of heat may be a benefit rather than a detriment. Hence the producer ovens may be arranged in batteries in one part of the plant, and the engines placed where each will be near its allotted work.

In discussing the tests of the Bering River coal, we found that, even as good coal as that failed to do satisfactory work on boilers requiring forced draft. The Geological Survey made many tests of gas producers at St. Louis. They say:

These tests in the gas producer have shown that many fuels of such low grade as to be practically valueless for steaming purposes, such as slack coal, bone coal and lignite, may be economically converted into producer gas and may thus generate sufficient power to render them of high commercial value. Coals with ash as high as forty-four per cent, and lignites and peats high in moisture have been converted into gas that has been used in operating gas engines. It has been demonstrated that the low-grade coals high in sulphur and ash now left under ground can be used in the gas producer.

3. Gas producer engines are more efficient than steam engines.

The same report says:

It is estimated that on the average, each coal tested in the gas producer plant developed two and one-half times the power that it would develop if used in the ordinary steam boiler plant. It was found that the low-grade lignite of North Dakota developed as much power when converted into producer gas as did the best West Virginia bituminous coals when used under the steam boiler.

Dawson made tests in which he compared the efficiency of the gas-producer engine with the steam engine. His

first test was of a two hundred and fifty horse-power engine producing one hundred units of energy. He found: 1. To produce one hundred units of energy by a steam driven engine of two hundred and fifty horse-power it took eleven hundred and twenty units of heat energy. 2. To produce one hundred units of energy by a gas engine of two hundred and fifty horse-power it took five hundred and twenty-five units of heat energy. Therefore, for a two hundred and fifty horse-power engine, the gas producer engine is two and one-seventh times as efficient as a like steam engine.

His next test was of a forty horse-power engine. He found: 1. To product one hundred units of energy by a steam engine of forty horse-power, it took sixteen hundred and eighty units of heat energy. 2. To produce one hundred units of energy by a gas engine of forty horse-power, it took four hundred and ninety-four heat units. Therefore, for a forty horse-power engine the gas engine is three and four-tenths times as efficient as the steam engine.

Byproduct Gas And Coke Producer

In the byproduct oven the coal is heated and distilled without the air's coming into contact with the coal. The two major products are coke and gas; and the gas is then treated so as to extract the various byproducts.

The gas comes out of the oven very hot and may be treated in either of two ways: (1) By an alternate process of cooling and heating. (2) By a continuous process of cooling.

(1) Alternate process of cooling and heating.

The gas is passed through a cooler which reduces the temperature to 100 to 125 degrees fahrenheit, while at this temperature the ammonia is taken out and the tar is extracted.

This is the end of the cooling process.

The gas, now being freed from its ammonia and tar, may either be further cleaned and then passed on to be used in lighting and heating, or it may be washed with various absorbent oils for its byproducts.

The tar may now be heated gradually and as, the temperature reaches the boiling point of each of the various constituents in the tar, that product is taken off, then at a still higher heat the boiling point of another constituent is reached and it is taken off, and so on up to over 600° F. at least.

(2) Continuous cooling process.

This is the Walter Feld process of extracting the major byproducts. Feld reasoned that it is a wasteful process to allow the gas to cool, and the various contents in it without taking them out and then heating them all over again. The two principles made use of are:

(a) Each major constituent in the hot gas has a definite "dew" point. That is, when the temperature of the gas is reduced to that dew point that constituent is precipitated.

(b) The best way to take off each constituent is to have the gas come into contact with that constituent in liquid form and at a temperature a little less than its dew point.

Therefore Feld arranged eleven washers, or vessels, each containing a liquid of one of the constituents of the gas at about the temperature of its condensation.

The gas between its initial temperature and 600° deposited pitch. At 608° it came in contact with anthracene, and anthracene is deposited. So, with temperature of 420° it came in contact with naphthalene; creosol at 338°; solvent naphtha at 300°; xylol at 288°; toluol at 230°; benzol at 190°; cyanogen at 110°, and ammonia at 95°. Each constituent was taken out at its dew point.

The most common way however, in this country is the cooling, the heating the tar, and washing the gas process, because the object is simply to get cyanogen, sulphate of ammonia, benzol, and toluol. These products are well worth saving.

(1) Cyanogen is used in the cyanide process of extracting gold from its ore and in such poisons as cyanide of potassium.

(2) Sulphate of ammonia as a fertilizer is so valuable that it has been proposed to erect byproduct ovens for the prime purpose of making sulphate of ammonia for fertilizer. The following quotation from a recent paper expresses the fact of the value of sulphate of ammonia as a needed fertilizer.

Students long ago came to appreciate the seriousness of our farm problem. Every county has its farming community which is worth to it millions of dollars. This value is deteriorating because of the impoverishment of the soil. Farmers and farm workers by the tens of thousands are deserting their old communities, friends and environs to go into the distant fields of Western Canada. A large part of the East is now considered as practically unfarmable territory. Ohio is deteriorating and the point is rapidly approaching where even Illinois, Indiana and Iowa will become hard States in which to farm. The one thing which this land needs is to be fed with a soil enricher. One of the byproducts in the manufacture of coke is ammonium sulphate which is ideal for the enrichment of impoverished soil. I have in mind one farming district which now has under consideration the building of byproduct ovens not alone for the supply of gas but also for the ammonium sulphate and other byproducts.

3. Benzol and Toluol. The importance of extracting from the tar these two constituents was scarcely realized before the war. England, too, was asleep; Germany awake. Prof. Bone in a lecture in London, while war was going on, said:

Benzine was discovered by Faraday twenty years before Hoffman demonstrated its presence in coal tar. Mansfield distilled it and toluene from coal tar. After Hoffman returned to Berlin in 1865, the industry gradually left England and went to Germany. For years before the war, German chemists had been preparing the way for its use in war by providing for saving it from industrial processes while England was carbonizing it all. Germany's violation of Belgium and seizure of that country and Northern France had more than mere military importance. It was the coal fields for the manufacture of high explosives that the Germans wanted, the Westphalian coal

did not yield such large quantities of toluol or benzol as Belgium or English coal. For the supply of high explosives we depended entirely on benzol and toluol, and with our present method of carbonizing coal the supply is limited. The ministry of munitions was guilty of culpable negligence in disregarding the warning of chemists, and if we failed to keep up supplies of explosives it would be due to lack of initiative and insight on the part of those who should have known. After the war there must be a systematic investigation of the chemical nature of coal and a chemical survey of the principal British coal fields.

This charge of extravagant waste of coal products certainly applies to us, and the call to remedy it after the war is as urgent. It is a common saying that "Chemistry fought the war." And of the products of chemical skill, benzol and toluol are pre-eminent. Not only did benzol furnish high explosives but it furnished motive power. The scarcity of gasoline for use in their trucks and automobiles would have been fatal to Germany, had not the supply of benzol furnished the substitute. And it will help Germany on her way to recovery. It is said that benzol is used almost entirely in German automobile and truck engines.

If benzol is produced in excess of demand, or not used in engines, it is turned over to the chemical industry. Benzol is the chief raw material of the artificial dye-stuff industry. From it may come phenol, vanalin, ammonite, hydro-chinon,—a photographic product,—and antifebrine, as well as analyne dyes. Toluol gives benzoic acid, and benzol alcohol.

From the various primaries mentioned before in connection with the Feld process, chemistry derives drugs and dyes almost innumerable. Germany's pre-eminence in the field of dye-stuffs manufactured from coal tar should halt our waste.

Not only had Germany for years been developing the bases of her explosives and her motive fuel but she had almost cornered the market for medicines and certain

drugs. She had almost a monopoly of the dye industry. We can get along comfortably without most of the dyes, but if we can get them from what we have been throwing away, it is well to see if it is not worth while to get them. The way in which Germany was "putting it over" on England and us is well expressed by Dr. Howard in his "Industrial Progress of Germany," written in 1907.

The most interesting branch of the chemical industry is the manufacture of dye stuffs from coal tar. It is in this field that the most recent and brilliant achievements of the German chemists have been won. In 1860 all the dyes used were organic, and Germany was almost entirely dependent on foreign countries for her supply. The annual cost to the country was twenty-four million, one hundred twenty thousand dollars. By 1900, the import had sunk to almost nothing and the exports had risen to twenty-four million, three hundred thousand dollars. Almost without exception the discovery and production of coal-tar dyes remained in the hands of the Germans. The raw material is the byproduct of gas and coke manufacture, which was formerly a worse than useless waste. Now Germany not only utilizes all the coal tar produced in that country but imports large quantities in the form of benzol from Belgium, Great Britain and Austria-Hungary. All this import and more is sold back to these countries again, multiplied many times in value in the shape of dyes. Four-fifths of all the world's products of dye stuffs, as well as large proportions of the medical preparations derived from coal tar are made in Germany. The annual production of these dyes amounted in 1897 to thirty million dollars worth.

For centuries indigo had been one of the great items of import to the textile-producing countries. In 1897 the German chemist Bayer discovered a process of making artificial indigo, which revolutionized this trade. In 1902 the export of artificial indigo from Germany was eighteen million pounds. The discovery of this artificial indigo was no doubt brought about by the Feld process previously described. Anthracene,—from which Lazarene is derived, and from it indigo,—is precipitated from gas when it has been reduced in temperature to 608° F. Chemists who heated the tar to get the products mostly went but little above the temperature for boiling o ftoluol, or 230°.

Enough has been said to show how absurd and wasteful it is to burn raw coal and with it these valuable products. It is even more absurd to sell our coal abroad as we have been doing, and after they, as in Germany, have taken out of their coal the fuel, gas, and coke, sell us back at a high price products like the ones we have given them for nothing and boasted of our great export trade. Mr. Porter, in a lecture in 1914, said:

If the coke produced in the United States in 1913 had been made in byproduct ovens eighty million dollars worth of byproducts might have been saved and ten million more in the higher yield of coke. Instead of burning in a single operation, as is done in a combustion furnace using coal, whereby all coal and intermediate products evolved from it are burned for their heat value only, the byproduct ovens convert it into two improved forms of fuel, coke, and gas, with a combined heat value about eighty-five per cent of the heat of the coal, and in addition save the byproducts, tar, benzol, and ammonia which have a chemical value far exceeding their fuel value.

The case in 1919 was more impressive; in that year bee-hive ovens produced 33,000,000 tons of coke. If the coal had been burned in byproduct ovens, the output would have been 2,400,000 tons more coke; 400,000,000 gallons of the tar; 545,000 tons of ammonia sulphate; 82,000,000 gallons of benzol; 20,000,000 gallons of toluol, and 300,000,000 cubic feet of gas. The benzol wasted would have been enough to replace a hundred million gallons of gasoline. Ammonia sulphate wasted was enough to fertilize 10,000,000 acres of land, giving each acre 100 pounds of it, and estimated to increase the wheat crop by 80,000,000 bushels.

Effect on Labor

Aside from the direct economic value of this scientific use of the coal, it has been suggested that it will tend to stabilize mine labor. The miner now has little hope of moving up, each advance bringing better pay for its requirement of skill. An intelligent young man becomes a miner, he works year after year, each new year being just

like the old one. He sees young men in other industries win higher places by faithful work and study. If nothing more, he thinks his long years of service should bring him more wages. He asks an increase. The manager might be willing to reward him for his loyalty, but the kind of work he is doing is paid for at the same rate to all, the industry cannot stand an increase all around. Suppose the coal business is not simply a Hewing industry, but starting with coal mining as a first step it develops from step to step in a series of industries, each industry in the series requiring greater skill and knowledge and commanding higher wages, then the young man who has done his work faithfully in his present position and fitted himself for higher position does not strike for more pay, instead, he advances to a place of greater pay and greater responsibility.

METHODS OF INCREASE OF EFFICIENCY IN THE USE OF COAL

(1) *Intelligent Self-Interest As Knowledge Increases*

Burning in furnaces. Increase of efficiency in the use of coal is encouraged by helpful information in bulletins issued by the Bureau of Mines, showing how to burn coal in both domestic and industrial furnaces; by schools for firemen on railroads, in which expert fuel engineers instruct the firemen in methods of firing so as to save coal; by companies that send out fuel engineers to inspect the furnaces of their customers and show the firemen how to fire their coal and show the customers what kind of furnace they need; by furnace makers, who are improving their furnaces and appealing to buyers on the ground of their fuel saving; by introduction of stokers because they save coal and also labor cost.

Byproduct Ovens

Centralized plants are being made to pay as investments, and that will attract capital.

For the first time in the history of coke-making in the United States more coke was made in 1919 in byproduct

ovens than in bee-hive ovens, being 56 per cent of the entire coke output. In 1919, 1228 new byproduct ovens were completed, of which 718 were new plants, the rest being extensions of old plants.

In 1919 byproduct ovens produced 35,000,000 tons of coke, using 50,000,000 tons of coal, and producing 668,000,000 pounds of sulphate of ammonia; 251,000,000 gallons of tar; 140,000,000 gallons of crude oil, and 370,000,000 cubic feet of gas.

A single steel company is burning 2,000 tons of coal every 24 hours, the byproducts being 2,000 gallons of crude tar; 6,000 pounds of ammonia sulphate; 7,000 gallons of light oil; fuel gas for boilers and electrical driving machinery in mines, quarries and furnaces, and overplus of 7,000,000 cubic feet for market.

The St. Louis Coke and Chemical Company is constructing a byproduct plant at Granite, Illinois, which will, when the four units of 80 ovens each are completed, coke 8,000 tons of Illinois and Indiana coal every day.

(2) Government Regulation and Control

(a) Burning in furnaces. The mining department has not accomplished its full purpose if it does not help and control, so as to lessen waste and promote efficiency in coal consumption as well as in coal production.

The inspectors report all conditions in all the mines, including the kind and efficiency of their furnaces and boilers. These should be under a sensible, helpful, but firm control. If a mine doesn't need a change, no harm is done; if it does, it will be benefitted.

Other plants, if found to be wasteful and unwilling to change, might be denied railroad facilities in coal. During the war coal was denied to some industries that wasted coal.

(b) Byproduct plants. As stated before, a consistent effort is to be made to centralize and conserve power. It should be the duty of the Mining Department to study the

various coal fields ; map out a general scheme of centralization ; if possible, enlist capital in carrying it out. A system of loans by the government could be established similar to farm loans,—money to be loaned when needed to hasten construction of byproduct plants and hydro-electric “super-power” plants.

CHAPTER XVIII

AUXILIARIES TO OUR COAL SUPPLY

Oil: Old Oil Fields Nearly Exhausted—Oil Fields in the Western part of United States—Southwestern Oil Field—Oil from Oil-Bearing Schist—Mexican Oil Fields—Coal Operators Alarmed at the Invasion of Cheap Oil—Indirect Effect: Lessens Freight and Lessens Demand of Engines for Coal—Operators Demand a Tariff on Oil.

In discussing coal conservation, it seems proper and necessary to give a statement of the way in which oil and "white coal" or water power auxiliaries help conservation.

Oil As a Conservation Help

If we were to state it as coal operators would, it would be "oil as a menace to the coal industry."

Our Present Home Contribution

The old oil fields are practically exhausted, so far as being an aid to conservation or a "menace" to the coal industry is concerned. The production is so small that it sells for more than six dollars a barrel. If a barrel of oil is equivalent to one-fourth of a ton of coal, coal would have to sell at twenty-four dollars a ton to be as dear as oil.

There never was a time when "Pennsylvania Oil," which is the standard oil of the world, could supplant coal by its cheapness. When this oil was so cheap that it was used most wastefully, coal also was so cheap that it was both mined and used wastefully.

Appalachian or "Pennsylvania oil," was sold at fifty cents to ninety-six cents a barrel, while coal was sold at ninety-five cents a ton.

Oil Fields in the Western Part of the United States

California has been the great oil state of the West. It commenced to produce oil about 1860, and by 1904

produced one-fourth of all the oil then produced in the United States. Some of the wells rivalled the great wells in Mexico, flowing ten thousand barrels a day, and the output was so great that it sold as low as seventeen cents a barrel.

Oil could not be called a conserver of local coal in the West, as the coal is in scattered areas, and mostly poor coal. It might better be said that it supplemented coal. Industries, which would not have been developed by the use of coal, were developed by the use of oil. It increased railroad facilities, as it now fuels the railroad engines on the roads running east and west for many miles. It fuels ships that ply in and out of San Francisco and along the Pacific Coast.

It will conserve the Pocahontas Coal that would have been carried to the Pacific Coast to coal our battleships, by now fuelling them with oil. Oil in California is now being used less wastefully and more scientifically. It is being fractionated, so that valuable byproducts, such as gasoline and kerosene, are being extracted and the fuel oil used for burning directly.

The Southwestern Oil Field

The Southwestern oil field is situated in several detached fields in the States of Texas, Louisiana, Oklahoma, and Southern Kansas. The production is at present increasing. Some of the wells are now shut in, and their possible output is not definitely known. If we believe the circulars sent out by promoting companies, if all possible production were let loose at once, a dangerous flood would result. This field, like other fields of large production, has suffered from the ignorance and dishonesty of many operators. Ignorant men think that a space large enough for a derrick, surrounded by large producing wells, will last indefinitely; dishonest promoters secure a small area and proceed to issue millions of stock on the strength of a single well, which, even if large, can last but a few months.

In this way the areas in the oldest fields of the Southwest are being rapidly drained. In one field in Louisiana, 68 per cent of the deep mines were dry, and the large wells declined 85 to 95 per cent in a year.

The field will yield a large production, however; wells of ten thousand to twenty thousand barrels a day are struck. It is a pity that there cannot be a control exercised that will keep these wells closed that are not needed until "topping" plants can be made, which ought to save the valuable byproducts, which are of more value when extracted than their heat value when burned raw.

Oil From Oil-bearing Schist in Various States

The United States Geological Survey announces that billions of barrels of crude oil exist in the rocky schist of Utah, Colorado, Wyoming, and other Western States, and that from forty to fifty gallons of crude oil can be obtained from each ton of this schist. The cost of mining and retorting the ore is small, as the rocks are standing above the surface of the ground, and can be dug out of the hill and sent down to the retorts by gravity. To mine and retort this schist will cost sixty cents a ton, and from a ton the forty gallons of crude oil obtained will cost a cent and a half a gallon.

From the forty gallons of crude oil, eighty gallons of gasoline, sixteen gallons of kerosene, and sixteen gallons of fuel oil will be obtained. This oil is, of course, not now available commercially. Experiment and investigation have shown the real value of this deposit to be great. It should not now be developed but held in reserve to take the place of some of the other sources of oil supply which the wild scramble for the ready dollar will soon exhaust.

Foreign Contribution to Our Oil Supply Mexican Oil Fields

The fields in Mexico, under development now, are near the eastern border of the country, within thirty or

forty miles of Tampico and Tuxpan. From Tampico it takes a tank-steamer from two to nine days to reach the various points on our coast.

The oil fields west and southwest of Tampico produce a very heavy oil, which can scarcely be sent through pipes without heating. Wells here are not so large, but flow almost indefinitely.

The fields south of Tampico and nearer Tuxpan produce a lighter oil, and the oil is piped to Tuxpan or Tampico. Enormous wells here produce as much as ten thousand to twenty thousand barrels a day. The export to the United States was thirty-nine million barrels in 1918, displacing about ten million tons of coal.

Much more would have been imported if tank-steamers and barges had been available. Now, since the war is over and ships released from overseas use and large numbers of new larger vessels are being built, the transportation will become ready for all the oil that can be sold.

It is estimated that the proved fields in Mexico can produce two-thirds of a billion barrels a year,—enough to equal in heat value all the coal mined in a year in Pennsylvania. It is not probable that anything near such enormous export as that will ever be reached. The present rate of output is one hundred and twenty-five million barrels a year.

Operators Alarmed by the Invasion of Cheap Fuel

Oil producers had too few customers for the output to which they had been forced by war demand. To have their old customers taken away from them by this new foreign competitor they regard with alarm and resentment. Their own cost of production has been greatly increased. Increased cost of labor, equipment, and supplies, increase in freight rates, make it impossible to compete with this new cheap untaxed "inexhaustible" rival. Cheap labor in the Mexican oil fields, wells flowing like a small river, set a price at the wells, at times, as low as one cent a barrel.

Long contracts have been made at Mexican ports for twenty-four cents a barrel. Cost of transportation in tanks and barges is so small that oil was sold at from sixty cents to a dollar a barrel on the Atlantic Coast. Oil sold in New England at a dollar a barrel would require West Virginia coal to sell at four dollars a ton, which is less than freight rate, with nothing for the coal.

Oil is carried up the Mississippi River and sold within twenty miles of the Illinois coal fields for less than coal prices. Barges are being planned to carry oil up the New York Canal, so as to compete with coal in the Lake cities.

Ships are being equipped to burn oil, engines use oil, oil is used for fuel in making china, tile, pottery, terra cotta, brick, in metallurgical furnaces, and for domestic use.

Indirect Effect

The more ships equipped to burn oil, the less bunker coal is needed, the less freight of coal from the coal field to the Coast, the less freight engine coal needed.

The freight engines that have hauled coal from the New England Coast to the interior will haul oil, and oil that will make as much heat as the coal it displaces will weigh less than two-thirds as much as the coal and take fewer engines to haul the oil and less coal to fuel them, even if they use coal. Eventually oil companies may pipe their oil from the Coast, and thus also supplant oil freight.

Operators Demand a Tariff on Mexican Oil

They demand protection of our high-priced skilled labor against low-paid unskilled labor. They say that men who have spent their lives and money to build up and supply a national necessity, who pay taxes and have had small profit, must not be destroyed. Industrial users, who are now changing to oil, cannot complain that their oil is taxed, they have been warmed into life and prosperity by cheap coal, which operators furnished them at cost, or below. A

specimen instance is given of a factory which was given coal during the war on a contract which netted the operator a dollar a ton loss. When the contract expired, the factory changed to oil.

It Is Not Likely That a Tariff Will Be Imposed

We need the Mexican oil to conserve our domestic oil and its byproducts. The Bureau of Mines says:

The consumption of petroleum is increasing far more rapidly than is domestic production. During 1918, we imported thirty-nine million barrels and withdrew from stock twenty-seven million barrels. Our future supply of oil must be conserved, it is imperative that the United States make every possible effort to further more efficient conservation of our underground reserves of oil and the more efficient use of oil and its products, because:

(1) Oil has become the basis of the industrial and military life of the nation in that gasoline has become the motive power for some six million automobiles and trucks, for airplanes, farm tractors and motor boats. Lubricating oil is essential for machinery of all kinds, and not a wheel would turn without it.

(2) The known oil reserves of the United States are not receiving adequate protection, and are being wasted through inefficient methods in production, refining and using the oil. The waste in oil and natural gas in the United States amounts in a year to \$2,000,000,000. The United States must take every step possible towards conserving our resources of oil.

This sounds like what we have been saying about coal, only that conservation of coal is even more important than conservation of oil. Motor oil, a byproduct of coal, is from twenty to thirty per cent more efficient as a motive power than gasoline, and there is another lubricant as good if not better than oil.

Pertinent as this appeal is, it will fall on deaf ears. The new leasing law opening to exploitation the vast oil fields of the West has nothing in it to safeguard the oil. It simply invites a repetition of the criminal waste of the past.

It is possible that consumers, who have turned to oil

burning, are building too largely on an inexhaustible, cheap oil supply, and coal men are unduly alarmed.

(1) Every oil and gas field on which high hopes were built in the past has fallen off in production, some have failed entirely. Some of the large wells in Mexico have flowed themselves out, and water has drowned out the oil in numbers of others.

(2) Oil from Mexico is already being increased in price, so that coal can compete in cheapness. These oil fields are falling into the hands of foreign owners, and they can divert oil to other markets, as they are doing to the markets in Cuba, South America, Trinidad, Jamaica, British Guiana, and St. Vincent.

M. L. Goud, writing in April, 1920, says:

To-day, owners of oil-burning steamers are having the greatest difficulty in arranging their supplies both at United States and foreign ports. The most unusual and expensive expedients are adapted to secure oil. Diversions of hundreds of miles are necessary to obtain fuel oil on certain voyages from the United States. There is a real scarcity everywhere. Two or three times the prices paid in 1919 are quoted. Prices up from one hundred, two hundred, three hundred per cent in four months.

We need all our domestic oil for its byproducts. While we are fractionating our oil for its valuable contents in addition to its fuel oil, we are using Mexican oil to save both our oil and coal.

This "invasion" of a cheap labor-saving fuel may drive our coal men to use their coal more scientifically. By constructing byproducts ovens at the mine, or in the center of a group of mines, saving the byproducts, piping gas for miles, or sending electric current, they may bring a more convenient fuel or energy to the domestic or industrial user, and thus meet oil on its own challenge of cleanliness, convenience, and low cost.

CHAPTER XIX

"WHITE COAL"

The Old Water Wheel—Water Split Up Into Steam—Centralizing Energy Sources—Three Kinds of Central Power: Steam Alone, Water Alone, Steam and Water Power—A Plan to Centralize Power Between the Boston and Washington Areas—Electrifying a Railroad By Water Power—Hydro-Electric Plant with Four Thousand Feet Head—Hydro-Electric Plant at Keokuk, Iowa—The Smallest Public Service Hydro-Electric Plant.

The Old Water Wheel

Some of the most famous paintings have as their picturesque feature, the mill dam, the mill, and the water wheel. The charm is not alone in the small pond of water, the rude mill, and water wheel but in the added mental picture that we draw of the farmer coming with his wheat and corn and going home with his flour and meal. It is the reminder of the bygone days, the days of the sickle, the horse-driven threshing-machine and the grist-mill. It is a picture of the unbought source of energy dropped from the friendly clouds ready for use, a source whose use does not diminish the supply, an ever-renewed source of energy.

The white coal is doing its useful and civilizing work.

The Steam Engine

There came a fortunate time when it was found that by splitting the water up into its vapor, and using it in the steam engine, a small amount of water could be made to do the work of a flood on the water wheel.

It might seem that the power of the water to do work had been increased manyfold. But not so. The steam in a proper sense is not originating any work at all. It is merely using the work that was done in expanding it. The

coal did the work; the steam is simply the rather wasteful but very convenient medium through which work is done.

If coal, therefore, is doing the work and being used up in doing it, and if coal is not inexhaustible, we must welcome every auxiliary that can do some of the work and save coal. Thoughtful men are turning more again to "white coal" as that important auxiliary.

Centralizing Our Energy Sources and Using "Super Power"

The very gratifying tendency now is to centralize our sources of energy. There are three kinds of central energy sources.

(a) Plants in which the total energy is furnished by coal. Such a plant as that may send out its energy in either of two ways: first,—by burning its coal in producer ovens and piping gas to distant points for use, or, second,—by generating electricity and transmitting it to distant users.

(b) The hydro-electric plants, in which the total energy is furnished by water power and the output is electricity.

(c) A "Super Power" plant in which electricity is generated by water power, but steam engines are "standing by," ready to be switched in to supplement water power at the peak of demand, or when water supply is low. The common output of the central plant is electricity. Much of the work in and about a mine is done by electricity. It is found cheaper and more convenient to buy electric energy. This energy may now be transmitted hundreds of miles. More and more hydro-electric plants are joined with steam "stand by" plants.

In February, 1920, the report received from three thousand one hundred and fifty (3,150) central power plants showed that 39.3 per cent of the load is carried by water power. Though this report shows what has been done

in recent time in centralizing power and making use of water power, greater things are in the plans of thoughtful men.

A Plan to Centralize Power Generators in the Eastern Part of the United States

The Geological Survey is asking Congress for an appropriation for making a survey and devising a plan for uniting all the power generators in the eastern part of the United States between Boston and Washington in "one large river of power," from which consumers, transportation lines, and industries should be fed from a centralized line. The Director of the Survey says:

We would study the possibilities of power production at the mouth of the coal mine, linking in with these the water powers that are available.

There is a certain amount of water power that is available and there are some very good water powers in that area, but they cannot stand alone. They must be hitched up with steam plants. Some of these steam plants would be put in at tide water and some near the mines. The benefits of such a power project, which we call a "super power," are that we make the best use of coal and half the coal which is used for power generation would be saved. The small plant that makes electricity on a small scale has only one-third or one-fourth the efficiency of the big modern plant.

Then we would go into application of electricity to our railroads.

*Electrifying a Railroad By Power from Waterfalls
Operating Trains Over the Great Divide by
Water Power*

The Chicago, Milwaukee and St. Paul Railroad operates its trains over its lines on grades which, for steepness over long stretches, are not matched in the United States.

For four hundred and forty miles,—from Harlowton, Montana, to Avery, Idaho,—over the Big Belt, Rocky

Mountains, and Bitter Root Range, which forms the Continental Divide, the trains are operated by electricity generated by waterfalls along the line. For twenty-nine miles of the line the grade is two per cent, for eleven miles one and two-thirds per cent, and for forty miles it is one per cent. Steam engines would have trouble drawing heavy trains up such grades. In normal times forty-two immense engines, weighing two hundred and eighty-four tons each, haul as much as thirty-two hundred tons each up a one per cent grade at a speed of fifteen miles an hour. Smaller engines haul eight hundred tons at a speed of sixty miles an hour. In addition to this railroad service, the power company has stretched a network of transmission lines over a large part of Montana and Idaho.

Eight Million Tons of Coal Saved by a Creek

Among the peaks of the Sierra Mountains, there is a basin into which drains the water from a watershed of eighty-eight square miles. It is bounded on the west by a low ridge and on the east by the Kaiser Range, ten thousand feet in height. The moisture-laden winds from the Pacific Ocean sweep over the low ridge on the west of the basin and strike the Kaiser Range on the east, which wrings out the water, sending it back down into this basin, which is seven thousand feet above sea-level, and out of which runs the Big Creek on its way down to the Joaquin River. The hydro-electric company has at its command the enormous head of four thousand feet in this creek. Down Big Creek is the first power house, at a lower level of two thousand feet. Here are installed the most powerful impulse wheels ever built, and the largest electric generators. The water, flowing out of six inch nozzles with a velocity of three hundred and fifty feet a second or two hundred and forty miles an hour, strikes the buckets of the wheels without shock, delivering 23,500 horse power. The water then flows on down to a lower level of two thousand feet, doing work in another similar power house. Every cubic

yard of water is worth twenty pounds of coal, and all together this water does the work of eight million tons of coal every year. The current is transmitted over the largest express line in existence, and at the highest voltage used commercially. The line is carried over mountains and desert to Los Angeles, distant two hundred and forty miles. It uses three thousand steel towers. The plant likewise serves local industries.

Hydro-electric Plant on the Mississippi River

The hydro-electric plant at Keokuk, Iowa, makes use of the largest stream of water in the United States, just as the Big Creek plant makes use of the highest head of water. The conditions are favorable at that point, as the steep bluffs on both sides of the river confine the water within fixed limits, keep it from spreading over the banks, and make good abutments with which to join the dam across the river. A dam four thousand two hundred and seventy-eight feet long is needed from bank to bank. The construction of the dam and its unusual features are very interesting but cannot be discussed here. The dam is made so as to be thirty-two feet above the normal level of the water; and as the river has only a fall of twenty-three feet in twelve miles, it makes a lake forty miles long and three to five miles wide. The river has a water discharge of from twenty-one thousand to seventy thousand cubic feet per second.

The turbines have a rated capacity of ten thousand horse power, with a head of thirty-two feet. The total capacity is two hundred thousand horse power.

Great as is the amount of power generated here, it is surprising to find that it does not generate much more than half as much as is produced by the Big Creek. The Big Creek can generate three hundred and fifty thousand horse power, while the Mississippi plant only generates two hundred thousand horse power.

Before the Keokuk plant was completed, a contract had been made to supply St. Louis for ninety-nine years with

sixty thousand horse power. This is carried to St. Louis by a transmission wire one hundred and fifty-five miles long. (Other cities near the plant clamored for electric energy, which could not be furnished. It is probably that this plant is capable of supplanting two million tons of coal.

The Smallest Public Hydro-Electric Plant

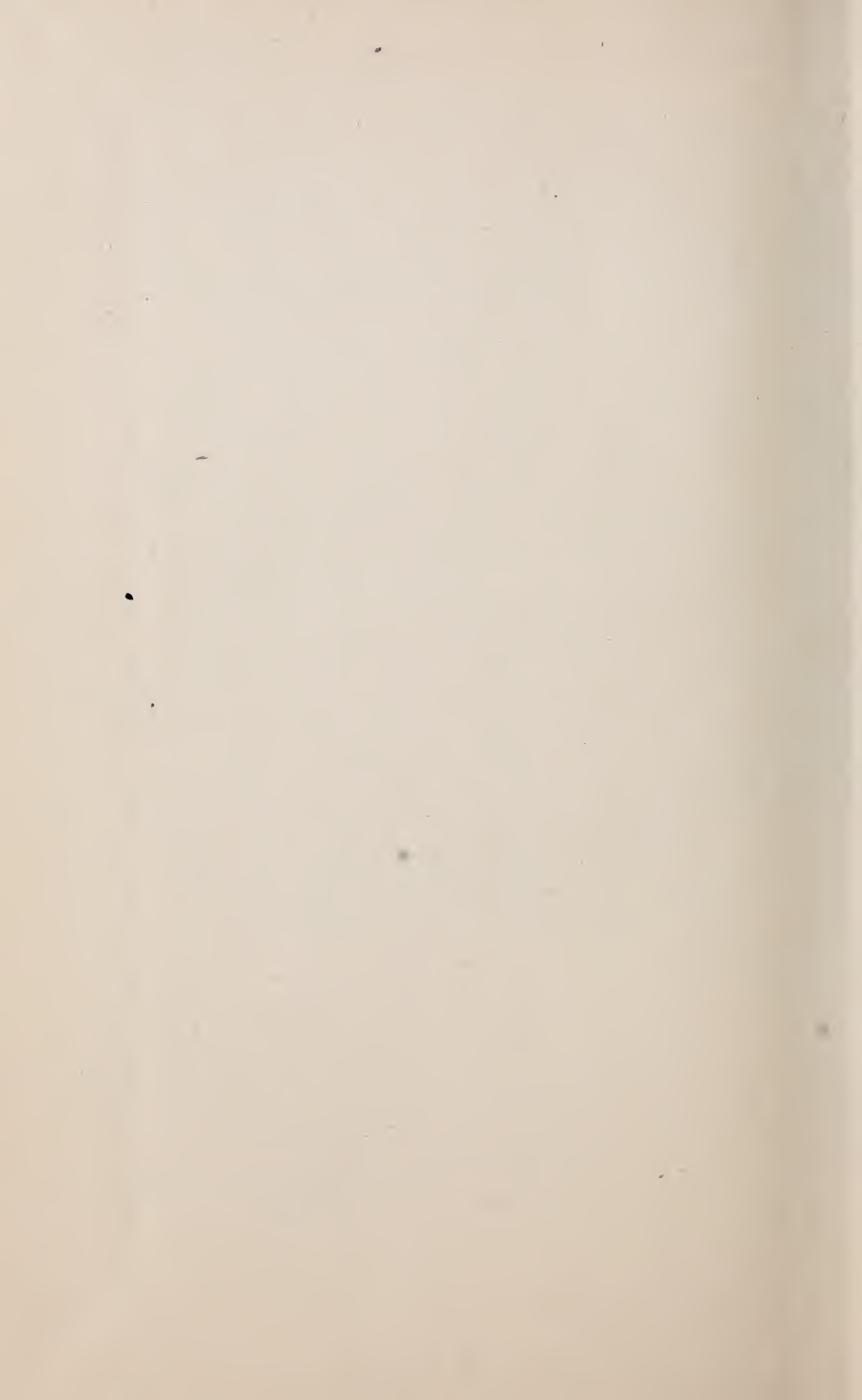
The smallest public-service hydro-electric plant known derives its power from a torrent in the gulch in the Little Cottonwood Canyon in the Wasatch Range, Utah. It was built by a town of four thousand inhabitants, at a cost of eighty thousand dollars. The power house is two miles from the mouth of the canyon, the water being carried to the power house by a thirty-inch stave pipe. The water has a fall of five hundred feet. The plant has two turbines and generators, each developing six hundred horse power.

The cost of power to the inhabitants is very small,—for lighting, at the rate of seven cents per kilowat hour; for cooking, two to five cents; on large contracts, one hundred horse power a year for one hundred and fifty dollars.

In order to show the great range of possibility of “white coal” as auxiliary to black coal, I have given as samples the extremes of hydro-electrification:

- (1) The longest and steepest railroad line.
- (2) The plant with the highest head of water.
- (3) The plant with the largest water supply.
- (4) The smallest public service plant.

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